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A proven and efficient floating wastewater treatment system

Floating Treatment Media

Lake Tikitapu
Ski Lane

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Contents

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A team of experienced experts, driven to deliver a superior project

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Executive Summary

Cleaning water of pollutants is an ongoing challenge for communities across the globe as the demand for environmental improvements grows in line with the need to find cost-effective and sustainable methods to remove ever-increasing amounts of contaminants from diverse bodies of water.

Waterclean Ltd's revolutionary low cost, highly flexible system of floating treatment media is meeting this need. This innovative system has strong scientific credentials based on the outcomes of independent trials, is an environmentally-sound process, and meets business requirements for sustainable solutions.

Developed alongside leading international scientists, Waterclean floating treatment media represents a highly technical development that uses, and improves on, a naturally occurring phenomenon.

In short, New Zealand-based Waterclean Ltd's active suspended media provide a colossal environment of active surface area for pollutant-digesting microbes and bacteria to bio-remediate water laden with nutrients, heavy metals or suspended solids. They represent an industry breakthrough with scores of benefits that include:

- **Cost savings:**
- **Proven effective performance:**
- **Self-cleaning:**
- **Minimal environmental impact:**
- **Flexibility:**
- **Zero land use:**

Waterclean and Kauri Park Ltd

Waterclean is part of the Kauri Park Group, New Zealand's leading commercial nursery. We have been working with the active suspended media technology, researching and refining the development of living media that mimic the purifying and filtration features of natural equivalents.

The performance of the product that has resulted from our investment over the past 10 years is nothing short of extraordinary: it defies the simplicity of the process and the low costs involved for users, and provides benefits that are well beyond those for traditional water treatment systems.

Today, value for money is the number one requirement when organisations invest in improving or replacing assets – local authorities, water agencies, private companies and landowners alike. For many, this priority is closely followed by the need to satisfy environmental issues.

Our innovative floating treatment media technology, as active suspended media, is based on more than 10 years' intensive research, combined with a natural process as old as the world itself, enables us to assure you that we can meet and surpass these crucial business needs.

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Can be used in any
water environment
requiring treatment

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Proposal

Wave Action Mitigation

Floating Treatment Wetlands in open water bodies can deflect and absorb the power of waves. Testing in laboratories has shown the force of the wave when it comes in contact with the floating platform, is forced downward at 90 degrees.

Nature has the lee of an island as a model for us to replicate.

The ability to create still water zones along the shorelines and enhance macrophytes in “bays” is possible with the inclusion of the Floating structures.

The ability to stop wave action eroding shorelines and establish riparian plants to bind the embankments is possible with the inclusion of the Floating structures.

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It is a simple process
with the strongest
scientific credentials

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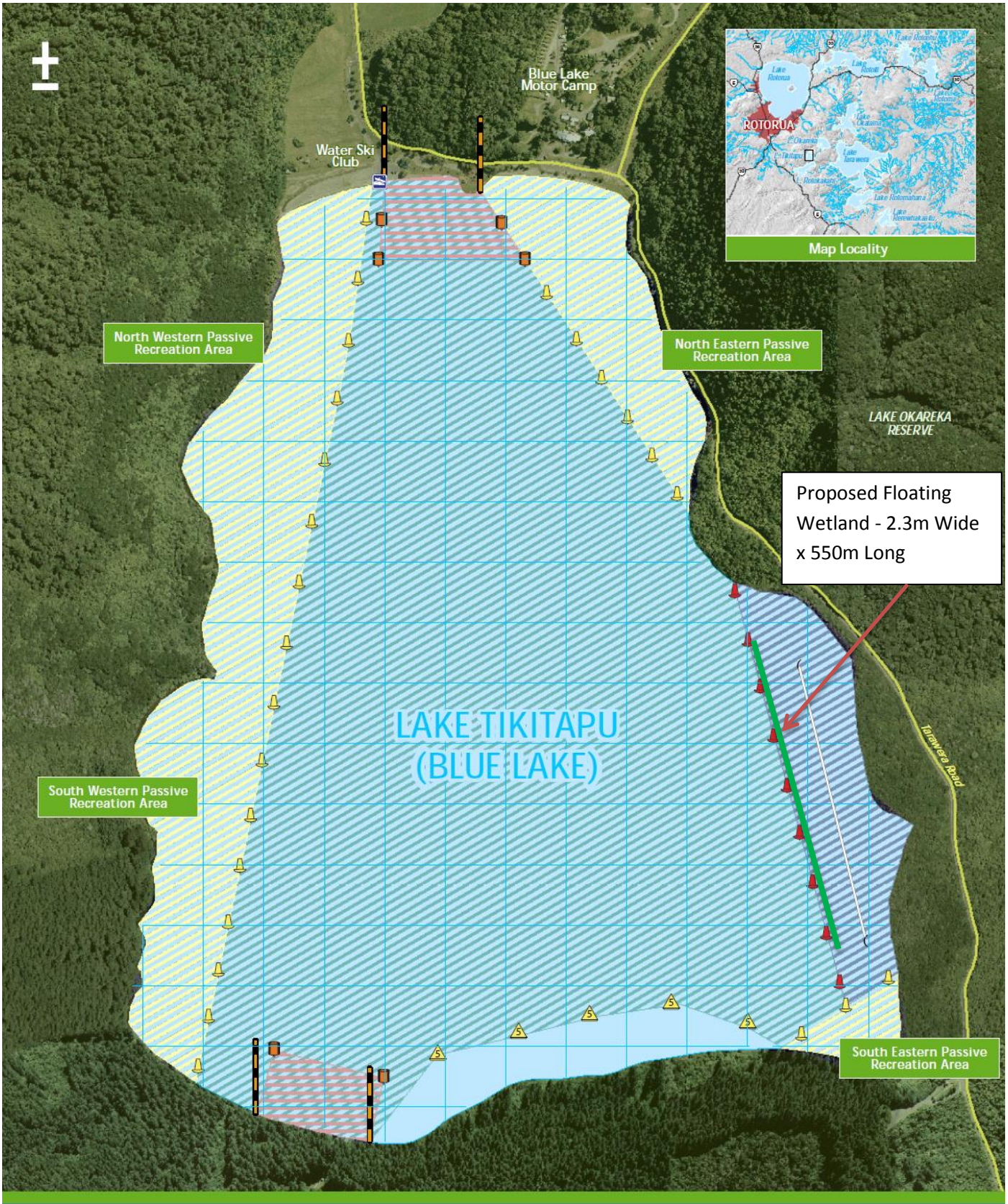

Lake Tikitapu - Base Map

100 0 100 200 300 400

Meters

Scale = 1:6,000

Bay of Plenty Regional Council

100m 100m

Navigation Aids

- Boat Ramp
- Boat Ramp (Closed)
- Slalom Buoy
- Water Ski Access Lane Buoy
- Water Ski Access Lane Post
- Water Ski Reserved Area buoy
- Water Ski Reserved Area post
- Yellow Conical - Swim no Boats
- Red Conical - No swimming
- 5 Knot Marker
- Cardinal Marker - East
- Cardinal Marker - North
- Cardinal Marker - South
- Cardinal Marker - West
- Passive Area
- Passive Recreation Area
- Water Ski Area
- Water Ski Access Lane
- Personal Water Craft Area
- Speed Restriction: Max 5 knots
- Wildlife Protection Area
- Area Subject to a Speed Uplifting

c2472 - November 2010

Floating treatment media are a highly advanced, cutting edge, biological technology

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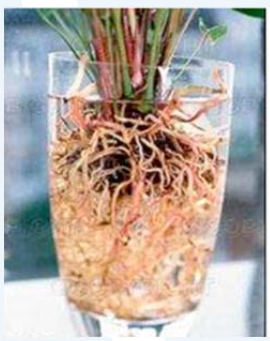
The Benefits of Floating Treatment Wetlands

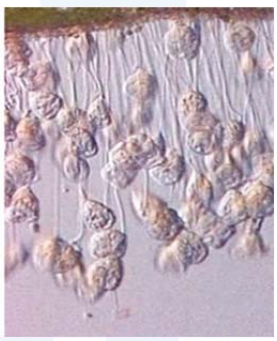
Floating Treatment wetlands provide the following main benefits:

- **Improved Water Quality**
- **Wetland Effect**
- **Habitat Restoration**
- **Natural Beautification**
- **Reduce Wave and Water Erosion**

Improved Water Quality

Floating Treatment Wetlands are made from a floating Matrix that has native sedges and rushes planted into the matrix. The plant roots then grow and suspend into the water column beneath the Floating platform. These roots provide Surface Area for microbes and bacteria that feed on the nutrients (nitrogen and phosphorus) within the water column.





Microbes adhering to root hairs

Microbes

A film of bacteria and other microbes forms on the Matrix and plant roots. These microbes eat nutrients and form biofilm in the process. It is this processes that removes nutrients (nitrogen and phosphorus) from water.

Microbes and plants

We want microbes and bacteria to grow and proliferate and be able to sustain and support their growth.

Microbes can't swim… they will sink and be lost to the base of a system…microbes are also light sensitive and are disinfected by UV light.

Unless we have very aggressive circulation we are going to lose a lot of our microbes to the sludge layer at the base of a water body.

Microbes can stick to surface area though. They excrete extra-cellular proteins which are sticky, and on plant roots they can grow into very high populations. Plants excrete sugars that the microbes feed off and can populate more densely through abundance of food.

So we're adding **surface area** into a water body allowing these critical microscopic life forms to grow and proliferate, all the while taking out nutrients and other bad pollutants out of the water **…today…tomorrow…next week…month…year…decade… generations.**

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Wetland Effect

Floating Treatment Wetlands bring about a natural wetland or riparian look.

Wetlands are a wide slow moving shallow water body containing plant stems providing surface area and biofilm attachment surfaces.

The water exiting a wetland is cleaner than when it entered.

Habitat Restoration

The Riparian Edge…this is where the transition of land to water occurs and this contains some of the most species and diversity rich ecosystems in the world.

It is the riparian edge that attracts the wildlife. Floating Treatment Wetlands provide large areas riparian edge and are really a magnet for wildlife.

Fish gravitate to the Floating Treatment Wetlands for both food and protection.

Riparian Edge is that transition from water to land so you can imagine how a Floating Treatment Wetland generates this critical zone.

Unfortunately we are seeing this critical riparian edge disappearing as we see human development encroach on these desirable shoreline zones as these areas are pleasant and beautiful places to live.

Floating Treatment Wetlands give us a tool to replace these lost ecosystems while further enhancing the desirable water body that has the human development presiding over it without taking up any of the developed land. This can be referred to as **zero land use**.

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Habitat Restoration

Due to the manufacturing processes that use a modular system to build the platforms, customization to suit and protect a particular organism is achievable. These Floating Platforms can be made to any shape, size, surface or idea.

Caspian Tern nest on a Floating Treatment Wetland in Oregon, USA. (See installation below. This floating platform has no plants as it is for bird protection only).

Natural Beautification

This speaks for itself. The beauty of the New Zealand wetlands and the diverse life form they contain is widely acclaimed. The Floating Treatment Wetlands are planted with native sedges and rushes and soon form a very natural appearing platform.

Looking out to the Floating Treatment Wetland on Lake Rotoehu from the shore.

A large Floating Island surrounding a walkway in Singapore.

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Reduced Wave and Water Erosion

Erosion of the shoreline around lakes in New Zeland can be attributed to the powerful forces of wind and wave erosion. It is thought that the loss of macrophytes around the lake edges is largely attributed to the wave action as these submerged plants became weakened with the increased nitrogen levels. With the loss of these crucial macrophytes the wave action then moved into the shorelines, and has continued to erode many cubic metres of soil and clay into the lake water.

The nutrients that were bound in these lost soils are released into the water column and sediments.

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Nature has the lee of an island as a model for us to replicate.

The ability to create still water zones along the shorelines and enhance macrophytes in “bays” is possible with the inclusion of the Floating structures.

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Lake Rotoehu – choppy conditions on the open water side & (below and the same moment) calm water on the leeward side.

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Summary of Benefits

Utilizing Floating Treatment Wetlands to target one specific treatment purpose will define the design parameters of that process. While we are achieving the result or working with an approach, all the other benefits become tied in.

In summary, all the different applications that have been presented also get the multiplicity of benefits that naturally are accounted to Floating Treatment Wetlands.

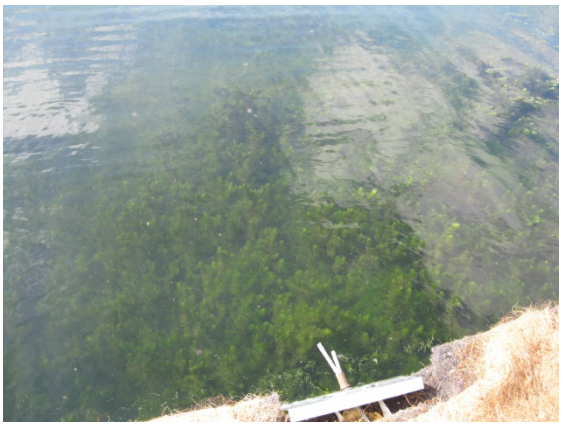
These systems offer a very concentrated wetland effect gaining all the benefits of:

- **nutrient removal**
- **wildlife enhancement**
- **sediment settlement**
- **wave action remediation**

...all concentrated into a small area achieving that of larger land based systems.

There are well over 3000 islands of our systems launched now around the world, trialling and achieving different concepts, and range from in the north, Alaska and Canada...USA...down through the southern states...Singapore and China...Australia...and way down here at the forefront of leading edge designs and some world firsts... NZ... and today's spotlight...Rotorua Lakes

Floating Treatment Wetlands provide a cost-effective, virtually maintenance-free alternative to otherwise challenging constructed land based solutions.



Macrophytes growing within an internal open area on Lake Rotoehu.

Koura living in the root zone beneath a Floating Wetland

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Truly
environmentally-sound
and sustainable

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Design Criteria

In designing the Floating Treatment Media FTM system for Lake Tikitapu Ski Lane, water quality sizing data is including as a benefit as per the following:

Removal Rate for FTM 1,265m²

Total Nitrogen	**925kg per annum**
Total Phosphorus	**380kg per annum**

Bioremediation Zone

To treat nutrient enriched water there is a need of additional sources of carbon and surface areas to assist in the denitrifying bacterial processes. The large amount of concentrated root will biologically treat the wastewater by:

1. Sticky bio film binds TSS to the root bio mass. The associated biomass will slough to the base of the system sequestering Organic Nitrogen forms, Phosphorus, Sulphates and Heavy Metals.
2. Provide anaerobic conditions for the denitrification processes within the large surface area provided by the plant roots.

The proposed methodology is an area of **550m x 2.3m** of biological treatment utilising Floating Treatment Media formed in a layout maximising contact with lake circulation and the mixing of the water column from the boating activity.

Floating treatment media are a fixed Biofilm process or activated suspended media

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Figure D – FLOW CONTROL

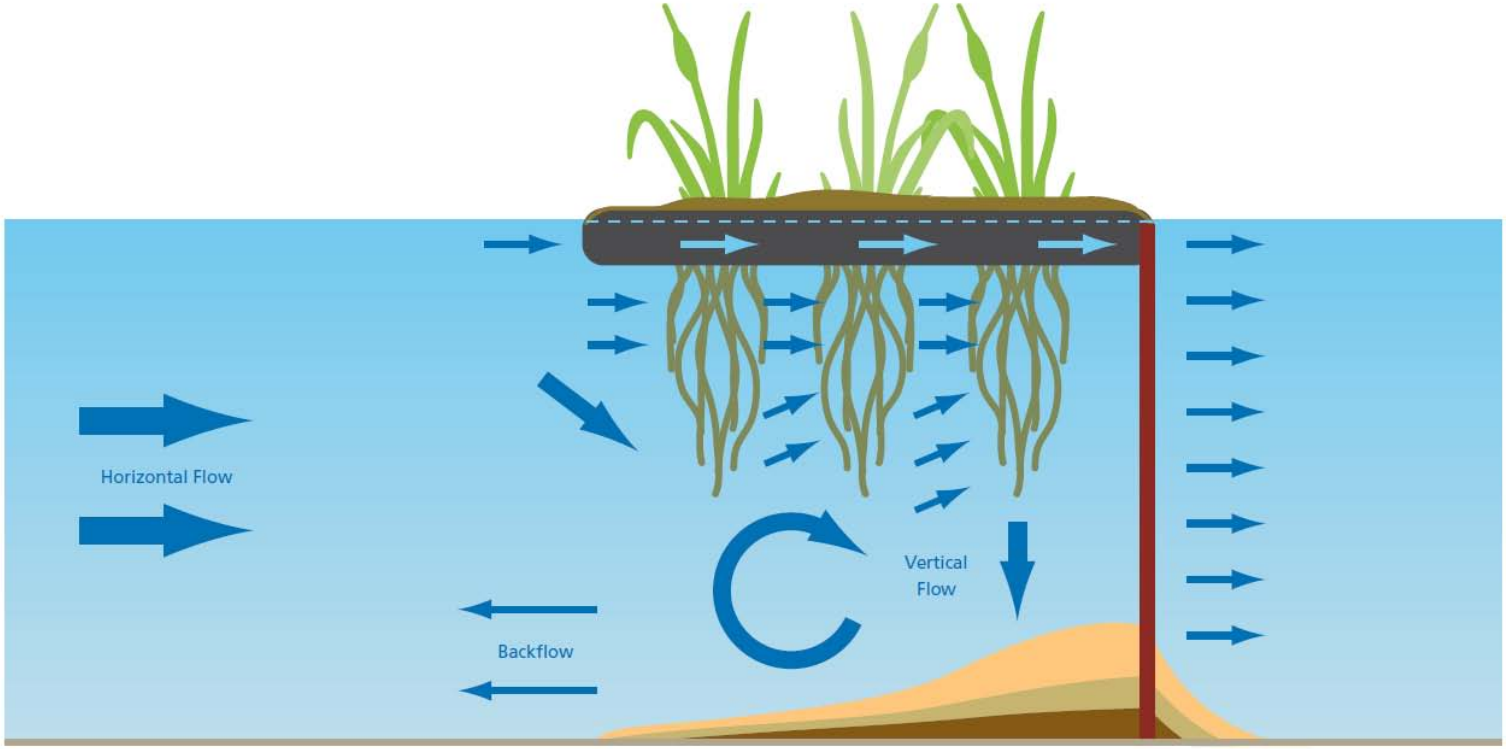

Figure E – TOTAL SUSPENDED SOLIDS CONTROL

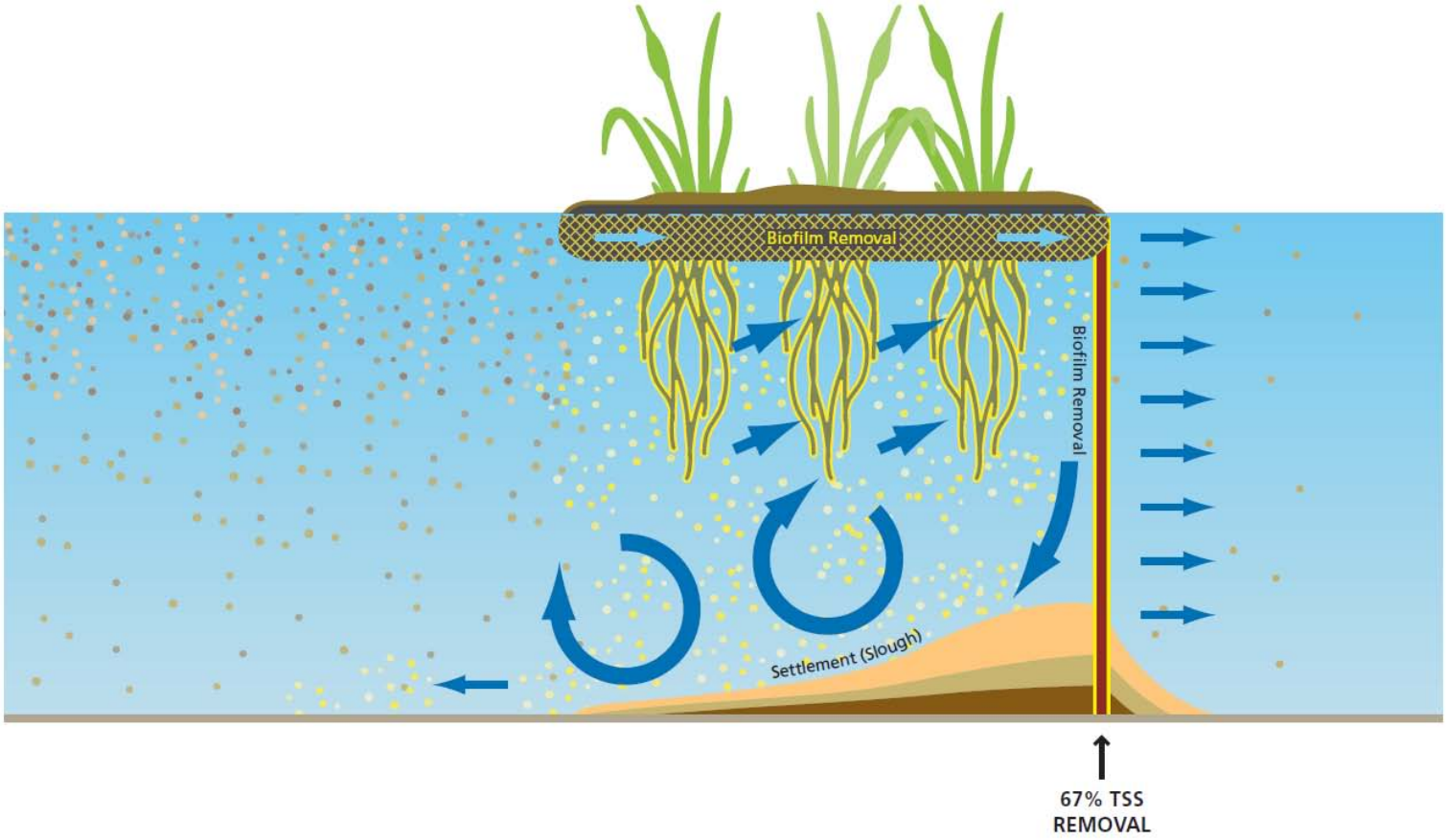

Figure F – TOTAL NITROGEN REMOVAL

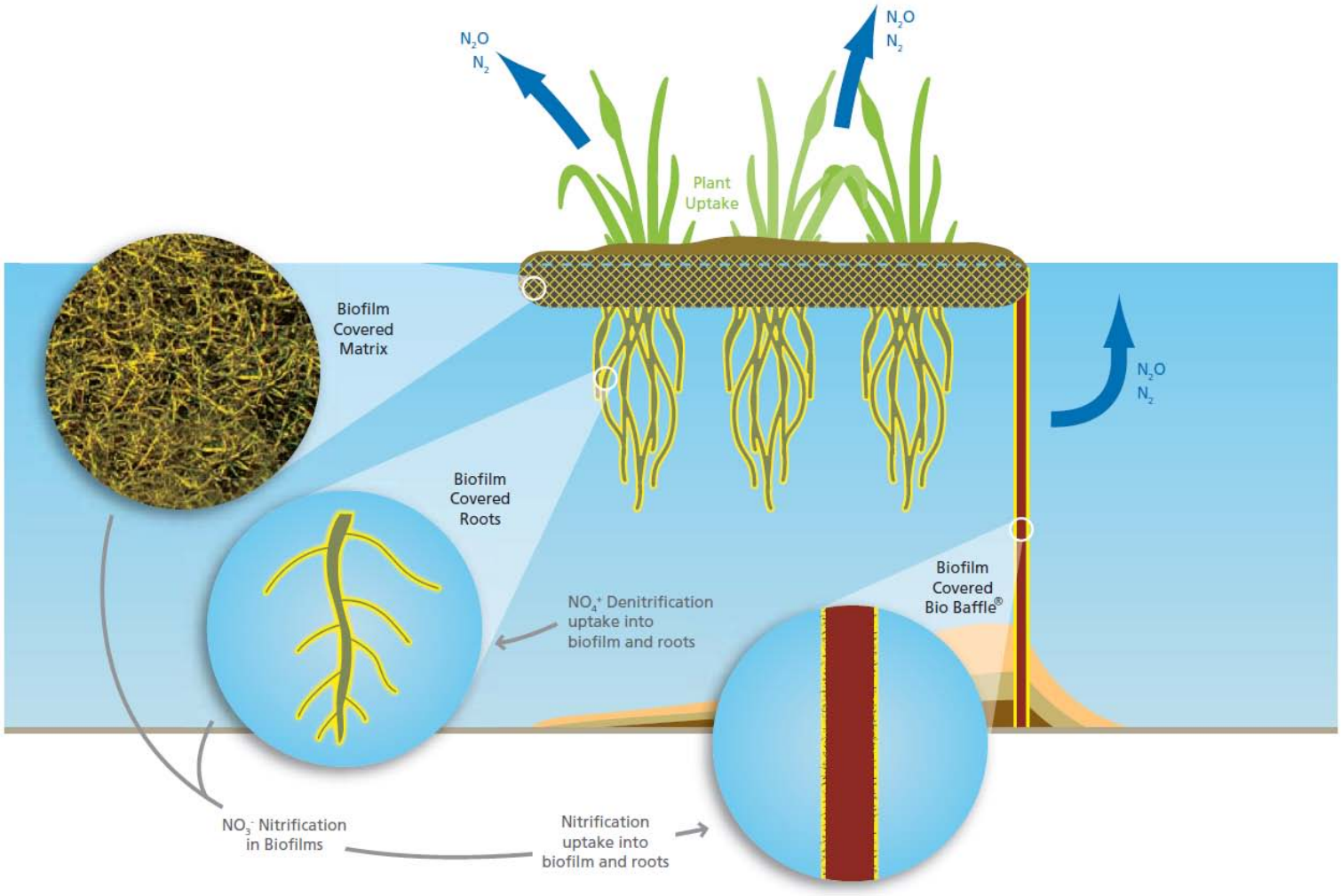

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Figure G – PHOSPHORUS REMOVAL

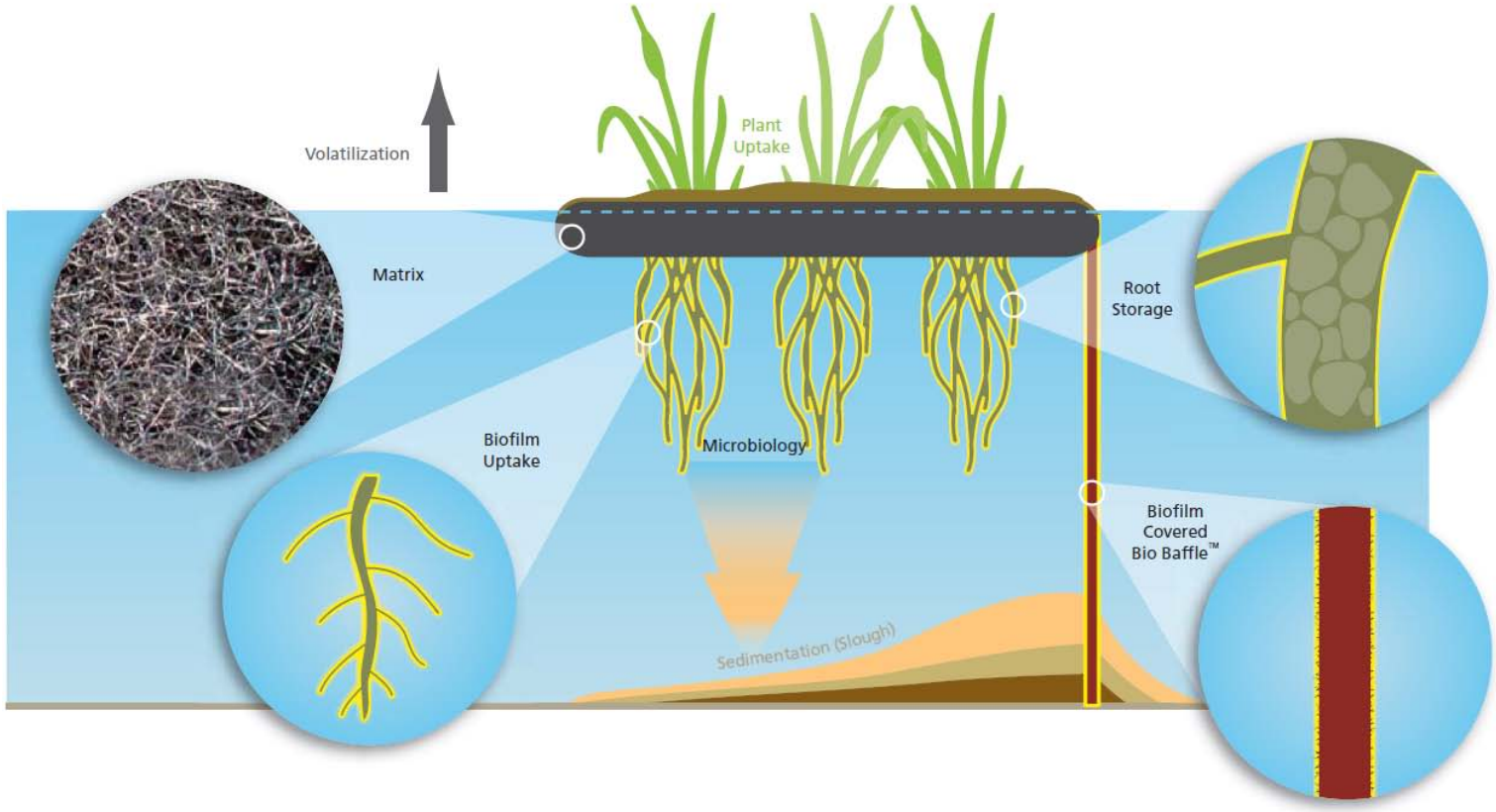
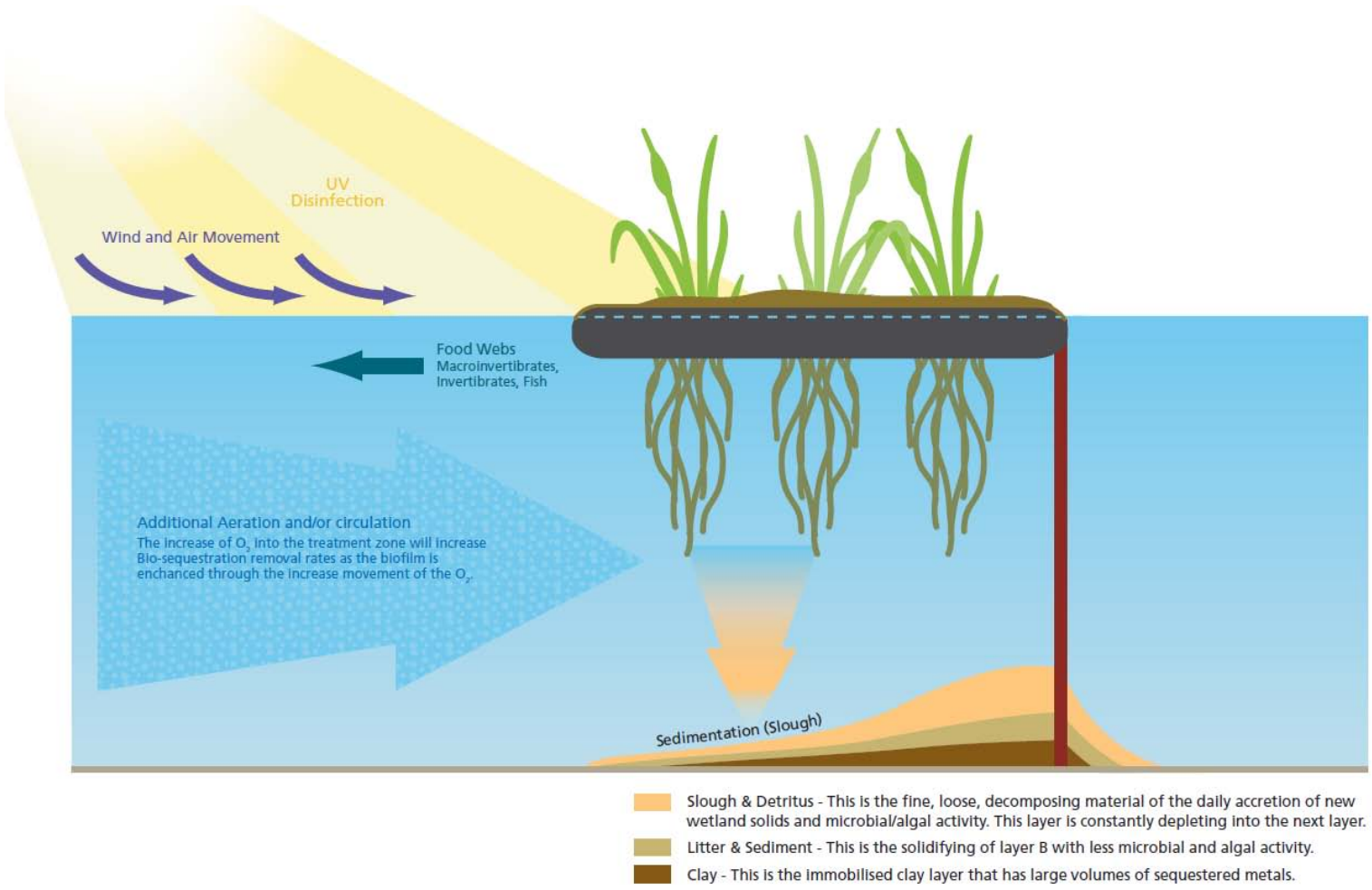


Figure H – ADDITIONAL TREATMENT



A low cost upgrade
– retrofitted to existing
facilities

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Maintenance

Waterclean Technologies will maintain the Floating Treatment Media for a period of 12 months post commissioning. This is to ensure that at handover the client receives a high quality, professional and technically sound system installation.

Maintenance includes the following Requirements:

- Waterclean Technologies shall monitor and maintain the system for a period of twelve (12) months from the date of Substantial Completion of the Floating Treatment Media system installation upon signoff.
- NOTE: Sampling and monitoring of the wastewater system is expected to be carried out by the client as part of the client's normal operation and maintenance procedures. Sample results are to be sent through to Waterclean Technologies on a regular basis.
- Waterclean Technologies shall submit a maintenance report at the end of each maintenance quarter. The maintenance report shall include all the inspection details as shown below and will be submitted in a format subjected to the approval of the client.
- Six (6) weeks before the end of the Maintenance period, Waterclean Technologies shall advise the client of the expiry date and arrange for all the preparations required for the inspection of the islands
- Waterclean Technologies shall rectify any defect found in the Works to the satisfaction of the client and Waterclean Technologies. The maintenance period will not be considered complete until after the final inspection is carried out and all remedial works, if any, are completed by Waterclean Technologies.

The maintenance of the Floating Treatment Media system shall be in accordance to the following frequency and procedure:

a) Plant coverage and establishment - 1 time per quarter to check on physical appearance and leaf colour as indicators of plant establishment status. Should the plant mortality rate exceed 5%, replacements are to be made to maintain a 95% survival rate.
b) Plant growth - 1 time per quarter plant growth should be monitored in $1m^2$ plots, replicated at least 3 times for each species. Parameters measured include plant height and plant numbers in each plot.
c) Buoyancy - 1 time per quarter buoyancy should be monitored by checking the water level on the indicator of the Floating Treatment Media modules
d) Weed control - every quarter any unwanted plants and other grasses which root on the Floating Treatment Media modules have to be removed carefully.
e) Degrading of the coir fibre matting - the top level coir fibre mat covering will degrade naturally due to its organic properties. This coir fibre mat is only required for the initial establishment stage. Once the rooting systems of the plants are established, the mass of the roots would replace the mat. There will be no need for replacement of the fibre mat.
f) Harvesting – No Harvesting Program has been incorporated in this proposal. Plant density is optimised to allow for this.
g) Plant mortality the expired plants for each plant species shall be replaced after installation as part of a twelve (12) month maintenance program. Waterclean Technologies shall ensure 95% plant survival at the end of the maintenance program.

Final hand over

- Prior to handing over to the client, Waterclean Technologies shall ensure the Floating Treatment Wetland system is in proper operating condition and all remedial works, if any, are rectified to the satisfaction of Waterclean Technologies and the client.
- Waterclean Technologies shall provide a minimum of 2 training sessions to familiarize the operations team taking over the operating regime of the Floating Treatment Wetland system during the last maintenance month prior to hand over to the client.
- Waterclean Technologies is required to submit an Operation and Maintenance Manual one (1) week after handing over the Floating Treatment Media system, detailing the inspection methods, frequency and anticipated maintenance required for the client.
- The Operating and Maintenance manual shall describe the procedures for the satisfactory long-term care and regular maintenance of the system, plants and materials and also recommend the components to be carried for spares.

Low capital
investment with
minimal operating and
maintenance costs

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Form of Guarantee

Waterclean Technologies will offer a replacement guarantee for a period of 10 years for all of the following categories:

Aluminium Joiner Plates.

The exterior joiner plates of the modular systems, are guaranteed if the installation is by an approved company signed by Waterclean Technologies. To this end, all bolting must be Stainless Steel and plates must be separated by neoprene if conditions require.

Anchoring & Tethering.

The anchoring and tethering of the modular systems are guaranteed if the installation is by an approved company signed by Waterclean Technologies. To this end, all bolting mechanisms must be Stainless Steel; tethering braid must be Stainless Steel or approved nylon where applicable. The anchor points are engineered and certified to meet the engineered design of the installation.

Product Life Guarantee

Non-Woven Plastic Matrix.

The Non-Woven PET matrix that Waterclean Technologies uses has been specifically manufactured for the intended purpose of Floating Platforms. The matrix is coated with a UV protector and this becomes secondary as the plants envelop the platforms. The matrix is manufactured to an engineered denier that will sustain constant wave action and movement and has a service life expectancy of 35 years.

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We provide
a complete service,
from design through to
installation and on-going
maintenance

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Lake Tikitapu Ski Lane FTW

From **Waterclean Technologies**
PO Box 63
Maungaturoto
New Zealand – 0547
Phone - +64 9 4312 125
Email – vern@kpn.co.nz

Contact Vern Wearmouth
Director

Date 28th February 2012

This price is for the installation and associated 12 months maintenance of the Floating Treatment Wetland ion Lake Tikitapu Ski Lane

Floating Treatment Wetland (FTW) (1,270m²)

- 1,270m² of Floating Treatment Wetland – 138 Modules of Planted FTW
- 50kg per m² of reserve buoyancy in the Planted Modules
- Coir- matting for FTW (1,270m²)
- Plants (6,350 wetland sedges – locally sourced)
- 92 Anchor Plates (2000kg restraint)
- 46 Anchors (supplied and placed by the Boat Club)
- 1,100m Stainless Wire Braid
- 920m anchor rope
- Manufacturing costs
- Full working drawings
- 12 months of maintenance

Installation of - Floating Treatment Wetland

- 2 weeks of specialised launch (specialised equipment charges)
- 1,100m Stainless Wire Braid
- 920m anchor rope
- Freight to Site

Sub Total **$ 284 625.00**

Please note:

- The above estimate is exclusive of GST
- The above estimate is valid for 90 days following the stated date.

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