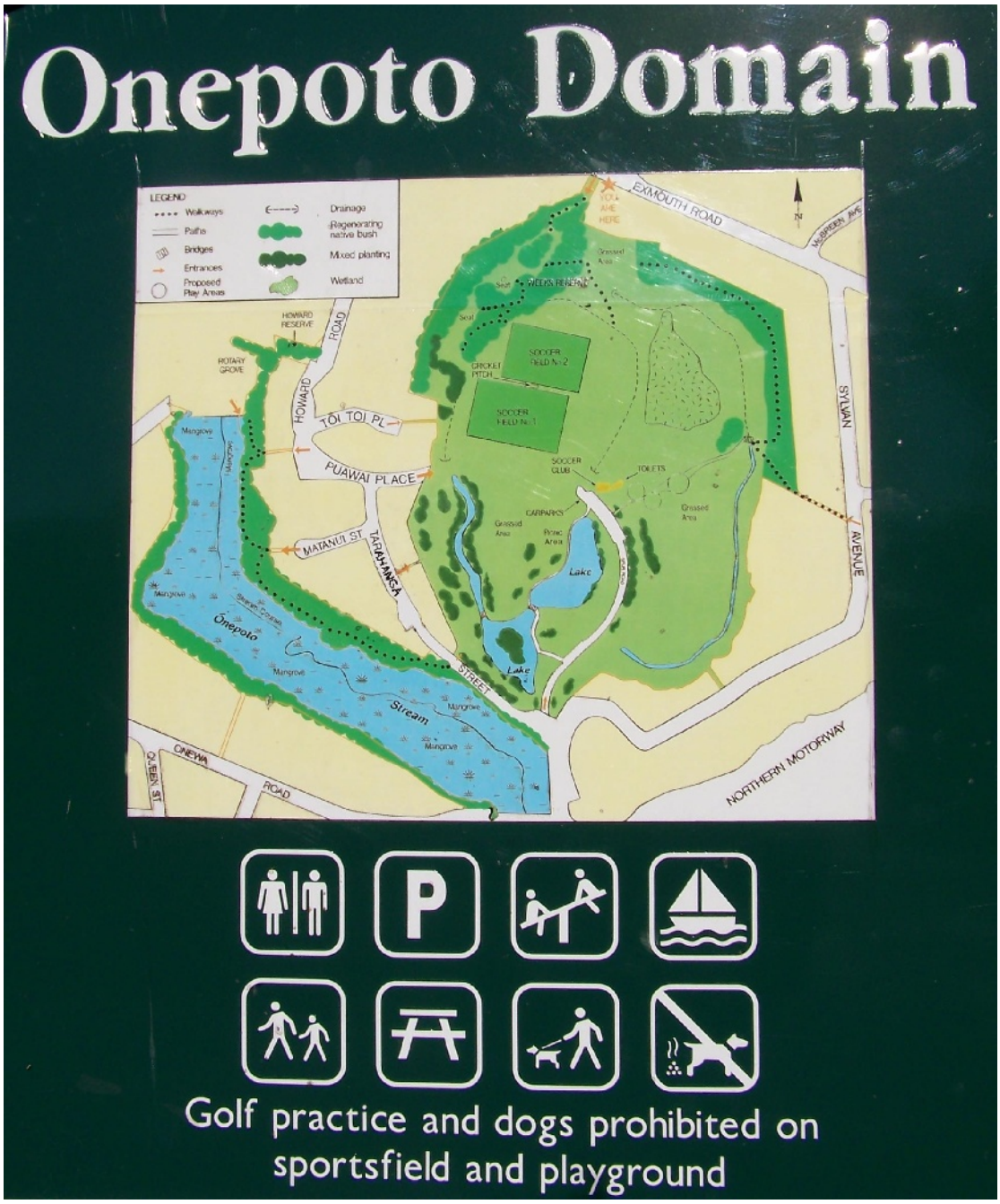
Onepoto Lagoon Coordination Committee



November 2007

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1. Onepoto Domain

Onepoto Domain started as a volcanic crater that formed 30,000 years ago and had filled to form a wetland and mangrove swamp. During the building of the Auckland Harbour Bridge some of the spoil from the excavations was used to form the sports grounds and recreation areas within the crater.

The Domain covers 26 hectares and contains parkland, native bush, the lagoon, some remaining wetlands, a football field and clubhouse, and a playground.

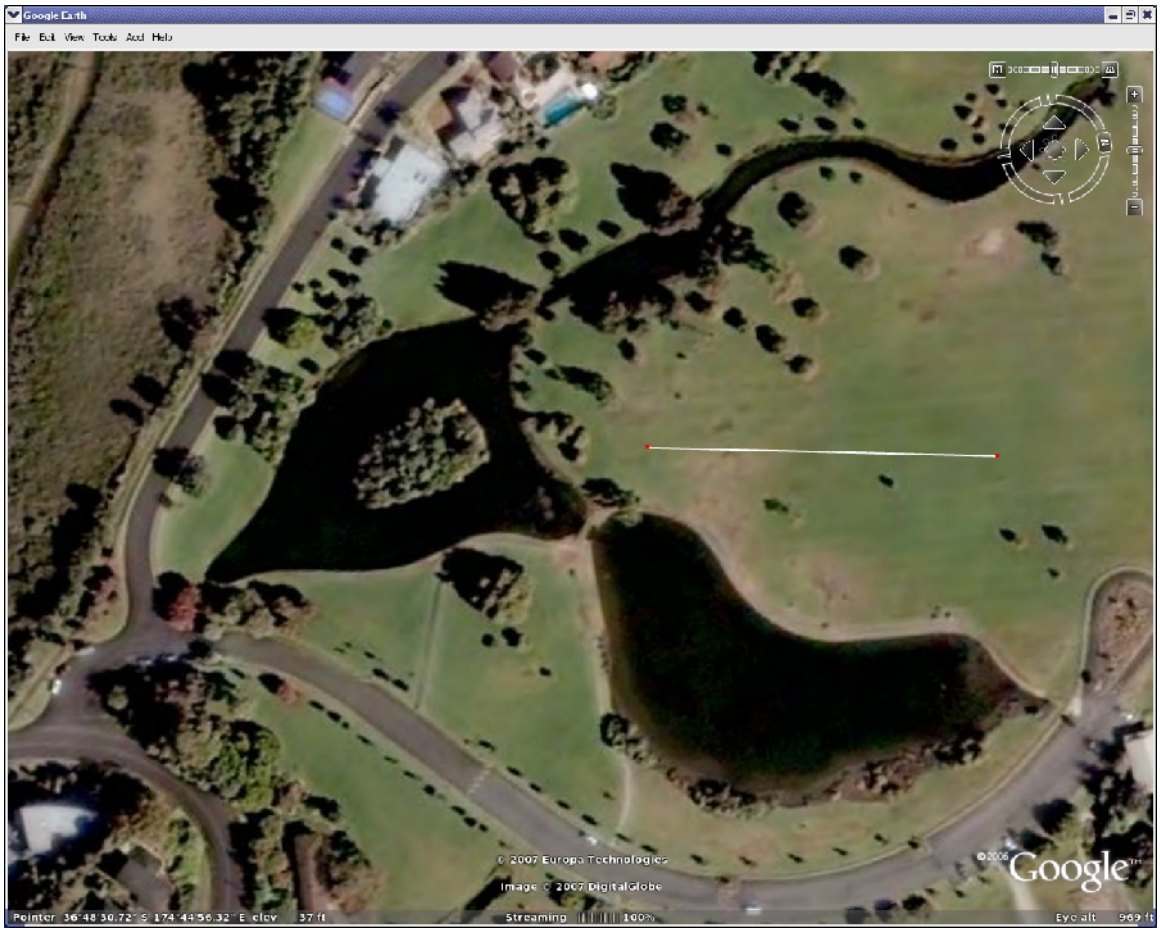
A view over the domain from the lookout in Week's Reserve

2. Onepoto Lagoon

The Lagoon was designated as a recreational facility and has covenants that cater specifically for its use as a model yacht sailing lake.

It also serves as a habitat for many types of birds including shags, ducks, pukekos, herons and gulls.

This view from Google Earth shows part of the Onepoto Domain with north to the right. Sylvan Avenue is shown in the bottom left corner. Tarahanga Street runs up the left side. The football club room in the bottom right.



The sailing pond is the one on the right hand side.

The control gate and fountain control are on the leftmost (south) end of the ponds. The outflow is on the estuary side of Tarahanga Street. For scale the white line is 100 metres long.

A view of the sailing pond from the clubhouse end looking south.

The southern pond from the bridge. The control gate is at the far end.

3. Pond Controls

Outflow flaps:

South of the road is the outfall to the estury and a concrete box holds two iron flaps that allow outflow and control the inflow. A large rectangular cover requires a screwdriver or similar to lever this up to open it.

A ladder leads down into the box about 15 feet deep at the base of which are hinged two flap valves covering the outfall pipes. A single chain is looped over the top rung of the ladder and each end is attached to a flap valve.

Normally the flap valves are left free and close as the tide rises. These are pushed open by any outflow at half tide and lower.

To allow inflow the flap valve must be raised by pulling on the appropriate end of the chain and then hook the chain to hold the flap open. This can only be done when the tide is half or lower due to water pressure. As the tide will often rise higher than the pond level there is a risk of water flowing into the pond and overflowing onto the grass when these are open. The limit is approx half tide.

By allowing two outgoing tides after removing the boards before the flaps are opened the risk of overflowing is considerably reduced.

When the flaps are closed some leakage will benefit the pond by changing a small amount of the water each tide. Placing the chain between the wall and the flap will allow inflow of an inch or two at high tide which drops back down during low tide.

Control Boards

At the south end of the ponds there is the outflow pipe covered by a stainless hinged flap. This is padlocked so the key is required. On the pond side of this is a stainless guard to prevent trash entering the pipe.

Under the flap is a control dam made up of wooden boards. Normally these are set so the top of the board is at the level required for the pond, any water above this height will spill over the boards and flow out at low tide. This view is with the pond very high.

Removing one or more boards will allow the pond to drain at half tide or lower and will allow inflow above half tide if the flap valves are open.

There is no storage for the boards when they have been lifted and they cannot be left. They are taken away and this makes sharing the flushing responsibility difficult.

Update: The angleiron crossbar shown in the photograh has broken away from the frame and sits across the concrete shoulders of the sump. The boards can be left by resting them on the rear shoulder and this bar, possibly tying them in place.

When replaced the boards need to be firmly pushed down and wedged the ensure they don't leak. This is best done when the water is the same level in pond and estuary otherwise the water pressure will prevent seating firmly. It should be checked at low tide and leaks wedged.

The boards cannot be reached without wading when the pond overflows. A vertical rack system is desired which could be operated remotely with a wheel.

If replacement boards are required the dimensions are:

Number:	2 boards
Length:	790 mm
Width:	293 mm
Thickness:	48 mm

The top board has an additional strip attached of 20 mm x 20 mm to raise the combined height to 606 mm. This keeps the pond level at approximately 2.2 meters relative to tide reference, or 350 mm above mean tide level.

The boards are fitted with 120 mm bronze bolts inset from each end which can be used to attach ropes should it be necessary to use a lever to remove them if they jamb.

Fountain Pump

An intake a few feet from the outflow feeds an electric pump which emerges as a fountain in the northern lagoon near the bridge. This mixes the waters of the ponds and provides some aeration. The pump is beneath a padlocked lid several feet from the pond edge and the switch is next to this in a black supply box.

The pump will overheat and burn out if it runs when the pond level is down so it must be switched off if the boards are removed for emptying.

Flushing Procedure

The inflow at high tide with the flaps open is faster than the outflow at low tide. This means that the pond will overflow at high if the flap valves are opened when the pond level is up.

First, one or both boards must be removed on an outgoing tide to allow the pond level to fall. This can be done for at least one complete tide before the flaps are opened to allow inflow. Two outflows will then ensure that pond level will remain below the footpaths duing the subsequent tidal cycles.

If the flush is required to remove floating weed or gassified silt then the level will need to drop below the guard over the outflow gates. This is approx 500 mm below normal level. It is also necessary to do the flush with a northerly wind, preferably a strong one, to blow the surface towards the outflow. The weather patterns may need to be a factor in deciding on the time to start the flush.

The quantity of water changed by each tide will only be 10 to 20 percent of the total volume, with a lesser amount changing in the sailing pond due to the restriction under the bridge. This needs to be measured by sampling the salinity in both ponds to ensure that it is kept within the range of acceptable levels while being adequate for controlling the algae.

Heavy rain will nullify the flushing as this will keep the pond level up and prevent adequate inflow.

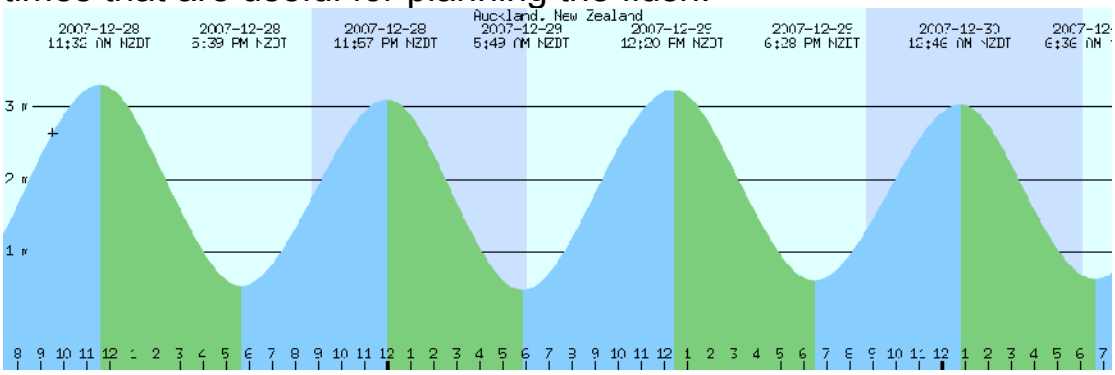
Fresh water will layer on top of the brakish pond water with estuary water sinking to the bottom. This will tend to prevent the higher salinity water getting over the dam between the ponds and will leave a marked difference in salinity between the ponds. This will eventually mix but may take a week or two to stabilize after the flush.

Planning and Timing

The pond level is at 2.2 metres relative to the tidal reference. Use of a tidal graph for the period will enable the optimum timing to be determined. Tidal graphs can be drawn using tide tables, obtained by running xtide on a computer or from various web sites.

Draw a line at 2.2 metres and one at 1.7 metres. These represent the normal pond level and the lowest that the pond will drain to. Where these lines intercept the tidal level curve will indicate the

times that are useful for planning the flush.



http://www.mobilegeographics.com:81/locations/270.html

Board removal:

The boards should be removed on a falling tide approximately as it is at or slightly below the pond level. If the tide is too low the pressure on the boards from the pond water will make them difficult to remove. If the levels are equal then the boards will float up easily when the wedges are removed.

Board replacement:

Again this is best done when the pond level and the estuary level are the same, and at the normal pond level. The board ledge will need to be swept to ensure the boards will seat without excessive leaks and the boards held down by, for example, standing on them while they are wedged firmly in place.

The leakage should be checked at low tide when it can be observed and some additional wedges may be required as plugs.

Flap Valve opening:

It is not possible to open the flap valves if the estuary level is higher than the level in the pond. It is difficult enough when there is no water on the outer side.

The valves should be opened during the second outflow at any time when the tide is below the current pond level, which may fall to the 1.6 metre line.

Flap Valve closing:

The chain holding the valves may be unhitched at any state of the tide. To allow some leakage, of an inch or two each tide, the free fall of the chain can be left against the wall so that it prevents the complete closure. This small gap will allow some breathing of the pond during each tide.

4. The problems at the pond

Silting is extensive.

The north end of the pond has an inflow from the fields under the road. The pipe (left) is extremely silted almost to the point of completely blocked.

For several metres from the inflow the silting has reduced the depth to just a few inches where is should be over a metre.

Silting is also extensive over the eastern and south eastern sides of the sailing pond with black slimy mud being up to half a metre deep.

Between the two main ponds and under the bridge there is a dam arrangement which is partly demolished and supplemented by a pipe. This restricts the flow from the sailing pond and increases the number of tides needed to complete the flushing of the ponds.

The pipe appears to be blocked with silt which restricts the outflow considerably.

The verical tracks indicate the position of a dam gateway, the surrounding concrete work has been reduced but still gives a level approximating the top of lower board in the control gate at the south end. The pipe is beneath this.

The south end next to the control gates is also very silted with a deeper pool around the control boards where it has been eroded by inflow. This highlights the amount of silt.

Pollution

This is at the nothern end close to the inflow by the clubrooms. It shows how shallow the silt has made this end but also the pollution. At times this has a very strong objectionable odour.

The Council advised:

A pollution prevention officer went and checked out the northern end of the pond and ascertained that the smell (sulphurous) was due to the anoxic conditions of the pond, a particular problem in these types of situations in summer and due to a lack of flow through. There was no sewage contamination.

Weed

The weed, which is likely to be Pithophora or Ulothrix, often referred to as "horse hair" algee, grows extensively in the summer months and can choke the pond. Over two or three weeks in march 2007 growth accelerated and it covered the surface over extensive areas of the sailing pond.

The south end of this pond around the fountain also has extensive areas where weed grows.

This view from the nothern end shows weed there and in the south east corner with weed clogging about 40 percent of the total pond area.

Anoxic Bottom

A problem related to the weed is the dead material on the bottom getting a light covering of silt and then decaying and producing gas. When the weather is warm and the sun shines on the shallow edges the decay is accelerated by the heat and the trapped gases cause the bottom to rise to the surface.

This is less of a problem to sailing than the algae as it tends to break up and be blown downwind to accumulate in a corner, but if the wind changes then it is spread over the pond. This then adds to the silting in the shallow edges.

Removing all the silt and decaying matter should reduce this problem. Also the depth of the pond would be increased, especially at the very shallow edges, and this would reduce the heating effect on the bottom. Keeping the weed under control will also reduce the production of decaying matter.

Overflowing

The pond is at about 2.2 metres relative to tide reference. Spring tides range from 0.4 metre to 3.6 metre.

When there is heavy rain the pond will overfill and, as this will not flow out when the tide is above half way, it may take a day or two to return to normal levels.

30th March 9:30am after heavy rain overnight.

The level had earlier been higher as indicated by the legs of the table. At sunset the level was still the same and as this was high tide (5:31pm) it would be some hours before it started to flow out.

Appendicies

Appendix A: Ecological Overview of Onepoto Pond

Both the pond and associated eastern stormwater channel show a similar profile. The channel must slowly empty into the pond through a culvert under the road but water movement is imperceptible. The pond water does circulate with wind and tidal inflow occasionally but movement and mixing is also very minimal.

With high rainfall (more than 60mm/month) the pH of water in the pond and in the channel is neutral around 6.5-7. With low rainfall both water bodies show alkaline conditions with pH of 8-8.5. The alkalinity does appear to be linked to salinity of the water. Salinity is measured with a hygrometer as freshwater has a SG of 1.00. When the SG is less than 1.01 the pH = 7, but when the SG elevates above 1.01 pH = 8.

The salt water is introduced to the pond periodically from the adjacent estuary through a gated weir. Salt water enters at high tide and pond water flushes out at low tide. This practice keeps the pond water slightly brackish in order to keep algal weed growth down to enable the pond to be used for model boating activities. Salt water kills the weed and keeps the water clear. The salt water not only kills the filamentous weed growth but must also kill the suspended single-celled algae as water clarity is improved from 60 ntu turbidity reading down to 7ntu on flushing with salt water. The salt water would also keep summer botulism down by killing the blue-green algae that produces the toxin that causes paralysis in ducks and other waterfowl. So, summer flushing will benefit the duck population at risk from botulism during warm weather when algal blooms occur.

Although no estuarine water enters the eastern channel, the ground conditions are salty, which is why the trees around the park are struggling. The changing salinity in the pond means that only species that can tolerate brackish conditions can survive. There are numerous brine shrimps, Potamopyrgus (aquatic snails) and freshwater mussels in the pond. These species are tolerant of marginal conditions (low oxygen, turbidity and high nutrient levels). Eels are evident and there must be fish as pied and little black shags frequently forage in the pond.

Ducks can survive on the surrounding grass area but probably also feed on worms and amphipods that would survive in the bottom mud. Welcome swallows catch the midges and mosquitoes

that hover over the water surface. The eastern channel has Gambusia (mosquito fish) so there must be mosquito larvae in the stream.

The oxygen levels in the pond have improved from 40-50% oxygen saturation in May/June to around 70% saturation since July. This may be due to the high rainfall combined with salt water flushing as this would have mixed and cleaned the stagnant bottom water. Oxygen levels are still not as good as they could be. Weed growth would improve oxygen levels short term but long term this would lead to further eutrophication of the pond and further stagnation. The best management for the pond to ensure good boating conditions and for the ecology is for dredging of the bottom anoxic mud to remove the nutrient build-up from dead weed, oxygenation and circulation of the water and salt water flushing to prevent further weed invasion.

Appendix B Flushing of the pond August 2007

Weed growth around the edge of the sailing pond was becoming a problem and a flushing was arranged to bring the salinity levels up. It had been recently measured at 1.010, 1.006, 1.004 and then back to 1.010. This change is due to rain leaving a layer of fresh water floating at the surface which then slowly mixes with the denser underlying water and indicates that 1.010 is probably the actual level.

At 9:30am on tuesday 28th August the pond was overfull by about 20cm due to rain overnight and this had been held in the pond by the tide which had been high at 6:55am, now it was overspilling the boards. The boards were removed to start the flush as the tide was approximately half out and falling. It was noted that the boards were rotten from being waterlogged for months and needed replacing. The fountain was also turned off at this time as otherwise the falling level can cause the motor to burn out.

As the additional water was nearly all that would run out over the low tide it was necessary to leave the flap valves closed for one high tide to allow two runouts. One flap valve was opened overnight during the second outflow. Only one was used to ensure that the pond would not overfill during each high tide.

Wednesday morning at 10am was was the time of the change of flow after refilling and the pond level was about the normal level. SG at the gate end was 1.022 and at the northern end 1.014. A check in the afternoon at its lowest point showed the level to be about 30cm below normal which is all that will flow out during each tide.

Thursday morning at 9am the water would still flow in for two or three hours with plenty of room to take it. The SG at the gate was 1.025 which is entirely estuary water. At the north end it was still only 1.014. The bridge restricts mixing so there is a lag in the SG rising. At 5pm the level was 30cm below normal with some remaining outflowing.

The flap valve and boards were replaced at 11am Friday with the water exactly on the correct level. The water was clear with SGs reading from 1.022 at the gate to 1.016 at the northen end which should even out as the water mixes.

Checking the pond on saturday afternoon revealed that the water level was down by 20cm or so. The gate was padlocked but it could be seen that the new boards were a loose fit and were

floating in their groove, allowing the water to drain. I returned later with a wedge and managed to open the lid sufficiently to push the boards down and install it. By this time the water was down to the top of the lower board and the weight of the top one had cutoff most of the leakage. I reopened the flap valves to allow the pond to refill.

On sunday morning after one high tide the level was still 15-20cm low but by midday it was up to the normal level. The final SGs were 1.022 at the gate and 1.020 at the north end which was the required result, the extra flushing over the weekend, though accidental, was a bonus.

Tide Times August 28 to 31 2007:

Tesday	**0**:32 a.m.	Low Tide	0.7m	6:52 a.m.	High Tide	3.0m
	12:55 p.m	Low Tide	0.6m	7:19 p.m.	High Tide	3.2m
Wednesday	1:20 a.m.	Low Tide	0.5m	7:41 a.m.	High Tide	3.1m
	1:41 p.m.	Low Tide	0.4m	8:06 p.m.	High Tide	3.3m
Thursday	2:06 a.m.	Low Tide	0.4m	8:26 a.m.	High Tide	3.2m
	2:25 p.m.	Low Tide	0.3m	8:50 p.m.	High Tide	3.4m
Friday	2:53 a.m.	Low Tide	0.3m	9:13 a.m.	High Tide	3.3m
	3:11 p.m.	Low Tide	0.3m	9:37 p.m.	High Tide	3.4m

Appendix C Flushing of the pond November 2007

Weed growth had been monitored by throwing a grapnel to the middle of the pond and dragging whatever was there ashore. As the SG decreased over time so the amount of weed and its length increased. It was decided to bring the SG back up by flushing before the weed became a problem.

		
Early October, the weed is green but short.	Late October, some weed is floating.	Late October, weed is long and still green.

date	main		fountain		south		
2007-08-23	1.010	14					
2007-08-26	1.012	15					
2007-08-28					1.018		
2007-08-29	1.014	13			1.022		9am
	1.014	15					5pm
2007-08-30	1.014	14			1.025		9am
	1.016	15	1.018	16	1.020	15	5pm
2007-09-01	1.019	17	1.020	17	1.022	16	2pm
2007-09-09	1.014	13					
2007-09-16	1.012	20					
2007-09-22	1.010	21					
2007-09-29	1.011	21	1.010	20	1.008	21	5pm
2007-10-06	1.004	20					
2007-10-16	1.006	20	1.008	20			
2007-11-02	1.008						5pm

By drawing up a rough graph of the tides over a few days it was possible to place the best times for opening the gates and the flap valves. Sunday the 4th had high tide of only 2.8 metres at 3:20pm so it was optimum to remove the boards just after sailing at 4:30pm. With the estuary and pond at approximately the same level removing the wedges allowed the boards to float up with no jambing.

Allowing two outflows with the flap valves being hitched open sometime during the second one would ensure that the pond would not overflow during subsequent tides. The flap valves could have been hitched anytime during the second outflow between 7am and 1pm on the monday. I did this at 12noon.

The flushing was then left until wednesday morning. The morning high tide was at 6:30am and at 9am the tide level and the pond were both just on the correct marks so the boards were replaced. The ledge was swept to remove any debris and ensure that the boards would close the gap without leaking too much. Standing on the boards as I hammered the wedges in place kept them from floating up.

Later, at low tide, I returned to close the flap valves and check for leaks. A couple of extra wedges reduced the spillage and as I unhitched the flaps I placed the chain against the wall under the valve to allow some inflow leakage which will give some breathing to the pond.

The SG was brought back up to 1.014 and the weed samples showed it darkening and reducing in length as it broke down in the saltier conditions.

	
Early November (before flush).	Mid november (two weeks after flush), weed is dark and breaking up.

2007-11-08	1.012	20	9am
2007-11-10	1.013	23	5pm
2007-11-11	1.014	24	5pm
2007-11-15	1.014	26	11am
2007-11-17	1.013	23	6pm
2007-11-25	1.016	23	noon

Appendix D Flushing of the pond December 2007

The week of December 8th the weed was just a patch of green at each end. A week later the whole pond bottom was green with weed. The intended outcome of a flush is to raise the SG back to 1.020 or so, as this seems to knock back the weed. The previous flush only managed to get it to 1.016 which did keep it down for a short time, but 52 mm of rain brought the SG back down to around 1.013.

The tides were correct on the 16th with the high tide at 1pm, and the wind was from the north so I removed the boards just after sailing with David Harley to help me. The tide had dropped below the pond level, and there was no water on the estuary side, which leaves the full water pressure to hold the boards in the slot. Pulling both sides we managed to lift the top board enough to fill the sump which then equalised the pressure and they came away easily.

I calculated that two outflows would be completed at just after 10am the next morning and I was there to see that the flow was just a trickle outwards as I opened the flap valves to leave it flushing both ways each tide.

From reading the tide graph (using xtide program) I predicted that at 6pm on wednesday the pond would be slightly overfull with the inflow quite slow. And so it was. I replaced and wedged the boards, closed the flaps, switched on the fountain and fed the ducks.