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CLEVELAND AQUATIC CENTRE
UPDATED POOL CONDITION ASSESSMENT
AND MAINTENANCE PLANS
(July 2014)

PREPARED BY

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1.0 INTRODUCTION

Council Pool Patrons rightfully assume that when using an Aquatic Facility it will be a positive experience i.e. there is little or no risk of injury or illness associated with the Facility's current condition.

In around 1850, leaders in the medical community refused to believe that something as simple as washing their hands before a procedure could prevent an infection. Germs that could not be seen were akin to witchcraft. A similar problem exists with swimming pools. Because disease carrying organisms are microscopic in size, infected pool water usually cannot be identified by pool users. It is only when a pool with inadequate pool water treatment experiences heavy bather loading (e.g. School Carnivals) that the pool's water becomes noticeably cloudy, providing pool users with a warning. Monthly microbiological testing is used to provide Council with a guide to the effectiveness of a pool's disinfection, at the time of the test and at the location in the pool where the test sample was taken. A pool's regular, all clear microbiological testing provides no guarantee to pool users that when using the pool, the water does not expose them to a health risk. That health risk can only be confirmed to be at an acceptable level by having a suitably qualified and experienced Pool Engineer review and report on the performance of all the important components of a pool's water treatment system.

Cleveland Aquatic Centre's first pool was a 50 metre pool constructed in 1978. The Centre's Lessee then built a 20 metre indoor pool in 1988 and an outdoor 25 metre pool and wading pool in 1994. In 2007 an outdoor water play area which included a Spa, Rapid River and Leisure Pool was constructed. We understand that all of the pools, with the exception of the 50 metre pool, were delivered by Design and Construct (D&C) type contracts. Municipal swimming pools delivered by D&C contract almost always lead to a relatively low construction cost and an extremely high whole of life cost together with substandard pool water quality. These pools appear to be no exception.

In an effort to quantify the scope of work required to upgrade the Aquatic Centre to a reasonable standard, Council commissioned an Audit Report in 2010 and a Condition Assessment and Planning Report in 2012. The 2010 Report clearly identified that the water treatment plants for the 20, 25 and 50 metre pools were in need of replacement. Unfortunately the 2010 Report provided little guidance for Council regarding the condition of the pools and the pipework connecting the pools to their water treatment plants. The 2012 Report used an elaborate scoring system to tabulate ratings and years of life remaining for each of the Aquatic Centre's assets. The 2012 Report's "present condition" rating of "fair" for the 25m and 50m pools and "poor" to "fair" for the 20m pool appear to conflict with its claim that the water treatment plants for all three pools were nearing "end of life". Like the 2010 Report, the 2012 Report provided little guidance for Council regarding the condition of the pools and the pipework connecting the pools to their water treatment plants.

2.0 COMPONENTS THAT HAVE INFLUENCE ON A POOL'S CONDITION

2.1 Pool Water Quality

Disease causing organisms can be introduced into pools from many sources but are mainly associated with bathers. These organisms can be brought into a pool on the bather's skin and their saliva, urine and faeces. Organisms can also be introduced from dust, bird droppings, make-up water, and soil carried on bather's feet. Some disease causing organisms live and may even multiply in pool water, unless the pool water is adequately filtered and properly and continuously disinfected.

2.1.1 Pool Water Testing

2.1.1.1 Regular Testing for Chemicals

Queensland Health Swimming and Spa Pool Water Quality and Operational Guidelines require pool water chemical testing three times a day in Council pools, in an effort to prevent the transmission of infections between pool users. Unfortunately what is not highlighted in the Guidelines is the important role played by the pool's filters and the need for regular recirculation of pool water through the filters. If small often microscopic particles are not removed by the filters, infections can be transmitted between pool users, even when pool water chemical levels are in accordance with the Guidelines. An even worse situation occurs when due to inadequate pool water circulation, pool water does not pass through the pool water treatment plant several times a day. Under those conditions, the pool will have areas of stagnant water that lack both filtration and the required levels of chlorine to act as a disinfectant.

2.1.1.2 Regular Microbiological Testing

The Queensland Health Guidelines recommend pools have monthly microbiological testing. Microbiological testing is intended to provide only a guide to the effectiveness of the pool's disinfection program.

2.2 Pool Quality

When reviewing the existing quality of a pool's components for a Condition Report, consideration needs to be given to the following components:-

- Pool's Applied Finish.
- Pool Concourse Hazards.
- Pool water loss through joints or concrete cracks.

2.3 Pipework Quality

When reviewing the quality of pipework connecting the pool to its water treatment plant, consideration needs to be given to the following:-

- Condition of the pipes.
- Location of the pipes in the pool.
- Capacity of the pipes to carry water.

3.0 OVERVIEW OF 2010 AND 2012 REPORTS

3.1 Overview of 2010 Report

In a Cleveland Swimming Pool Audit Report dated 15 November 2010, Stevenson & Associates have provided comments on each of the pools in the Centre and in an Appendix to the Report attached Spreadsheets detailing the Age, Condition, Anticipated Future Life and Estimated Additional Maintenance Costs for individual components of the pools and their water treatment plants. A review of the Report's comments and the contents of the attached Spreadsheets follow.

3.1.1 50m Pool

The 50m pool shell is described as "sound" with the pool's applied finishes, especially the gutters, described as "failing". The pool's balance tank is reported to have cracks. The water distribution in the pool is described as "poor". These comments provide Council with very little useful information. In the spreadsheets, cost estimates have been provided for the following:

Pool Maintenance	(1 to 5 years)	$150,000
	(6 to 10 years)	$437,000
	(11 to 20 years)	$174,000
New Pool Water Treatment Plant		$335,000 to $380,000
Pool Modernisation		
• Level Deck Gutters		$250,000
• Raised Ends		$ 70,000
• Replace Centre row of inlets		$ 70,000
• Retiling		$300,000
	TOTAL	$1,786,000 to $1,831,000

3.1.2 Indoor 20m Pool

The 20m pool and finishes were described as being in "reasonable condition" and the concourse as being "generally in good condition". The pool water treatment plant was said to be "in need of complete replacement". In the spreadsheets, cost estimates have been provided for the following:

Pool Maintenance	(1 to 5 years)	$ 41,000
	(6 to 10 years)	$ 49,500
	(11 to 20 years)	$ 82,000
New Pool Water Treatment Plant		$120,000 to $130,000
Pool Modernisation		
• Level Deck Gutters		$100,000
• Raised Ends		$ 15,000
• Tiles		$ 40,000
	TOTAL	$447,500 to $457,500

3.1.3 Outdoor 25m Pool

The 25m pool and finishes were described as being in "reasonable condition". The concourse was said to have "failed in each corner" and that the concourse topping slab "needs replacement". The pool water treatment plant was said to be "in need of complete replacement". In the spreadsheets, cost estimates have been provided for the following:

Pool Maintenance	(1 to 5 years)	$105,000
	(6 to 10 years)	$ 45,000
	(11 to 20 years)	$ 64,000
New Pool Water Treatment Plant		$143,000 to $168,000
Pool Modernisation		
• Level Deck Gutters		$125,000
• Raised Ends		$ 30,000
• Tiles		$ 90,000
	TOTAL	$602,000 to $627,000

3.1.4 Outdoor Spa Pool

The Spa Pool and finishes were described as being in "reasonable condition". A few minor improvements were recommended for the pool water treatment plant.

3.1.5 Outdoor River Pool

The River Pool and concourse were described as "generally in good condition". A few minor improvements were recommended for the pool water treatment plant.

3.1.6 Outdoor Leisure Pool

The Outdoor Leisure Pool and finishes along with the concourse were described as being in "reasonable condition". It was recommended that the slides be removed at an estimated cost of $2,000 or replaced at an estimated cost of $30,000. It was recommended that the water features be replaced however no cost estimate was provided. A few minor improvements were recommended for the pool water treatment plant.

3.2 Overview of 2012 Report

In a Condition Assessment and Maintenance Planning Report for the Cleveland Aquatic Centre dated April 2012, GHD clearly understood Council's requirements for the Report. The "Background" section of their Report listed the following items as specific Council requirements for the Report:

- A clear understanding of the current condition of the pool bowls and their associated buildings and filtration equipment.
- The works necessary for the centre to be restored to the desired standard.
- A 10-year forecast of maintenance costs to assist with budget preparations and funding models.

The report identified that the 50m pool, outdoor 25m and indoor 20m pools all had water treatment plants "nearing end of life" and that the 50m pool had "poor circulation" and concourse concrete in "poor condition". Despite these stated limitations, the 50m and 25m pools' "present condition" were assessed as being "fair" and the Indoor 20m pool's "present condition" was assessed as being "poor" to "fair". The 50m pool was assessed to have a remaining life of 24 years, the 25m pool 42 years, and the Indoor 20m pool 39 years. It appears illogical that the Indoor 20m pool which was assessed to be in worse condition than the 50m pool has a reported significantly longer remaining life than the 50m pool.

4.0 LIMITATIONS OF 2010 AND 2012 REPORT

4.1 Limitations of the 2010 Report

The 2010 Report concluded that the water treatment plants for the 20, 25, and 50 metre pools were in need of replacement. The Report provided cost estimates for work required to maintain the pools and their water treatment plants in reasonable working order for the next 15 years, without considering water quality limitations caused by the following:

i. Poor water circulation in the pool.

ii. Size and condition of pipework connecting the pool to its water treatment plant.

If there is poor water circulation in the pool shell, there will be areas of stagnant water creating potential health risks for bathers. Those risks will not be addressed by changes made to the pool's water treatment plant.

The size, location in the pool and condition of pipes connecting the pool to its water treatment plant will often prevent, or at least restrict, pool water quality improvement made by changes to the pool's water treatment plant.

By ignoring consideration of water circulation in the pool and size and condition of the pool's pipework, the 2010 Report has recommended expenditure on pool water treatment plants that alone will have little or no impact on pool water quality.

4.2 Limitations of the 2012 Report

Under the heading "Maintenance and Backlog Budget Estimates" the 2012 Report provides budget estimates for the next 15 years. Unfortunately the budget estimates are not broken down into work on pools and work on buildings, making our comments on pool cost estimates difficult.

A "Backlog" estimate of $228,195 is provided for work required "to return parts of the facility to the appropriate condition standard of 3 (fair)". Parts of the facility that are rated 4 (poor) and therefore require upgrading include the Kiosk/Amenities Building, 25m/20m Pool Plant Enclosure, 20m Indoor Pool Building and the 20m Indoor Pool. All of those parts involve buildings except the 20m Indoor Pool which has, according to the Report, pool finishes beginning to deteriorate and pool plant nearing end of life. It is unlikely that the estimate includes the 20m pool's plant as the 50m and 25m pools' plant have not been included in the "Backlog" estimate. The cost estimate for replacement of Pool Plant for the 20m, 25m and 50m pools appear to be contained, along with replacement of the 20m pool enclosure and other items in the $1,491,970 "Capital Replacement" cost estimate.

The above recommended work, for which cost estimates have been provided, has limitations including the following:

1) Remedial work on the 25m/20m Pool Plant Enclosure is included in "Backlog" work requiring "immediate attention". It is most likely that the 25m/20m Pool Plant Enclosures will be inadequate for the subsequent 25m/20m Pool Plant Replacements. Remedial work on the Plant Enclosures should have been programmed together with Pool Plant Replacements.

2) Once the 20m Pool Enclosure has been replaced, access to the 20m Pool for replacement will be difficult, particularly if the new pool shell requires support on bored concrete piers, as we suspect it will.

3) As was the case for the 2010 Report, the 2012 Report has not considered water quality limitations caused by the following:

   i) Poor water circulation in the pool.

   ii) Size and condition of pipework connecting the pool to its water treatment plant.

If there is poor water circulation in the pools, there will be areas of stagnant water creating potential health risks for bathers. These risks will not be addressed by changes made to the pool's water treatment plant.

The size and condition of pipes connecting the pool to its water treatment plant will often prevent, or at least restrict, pool water quality improvements made by changes to the pool's water treatment plant.

By ignoring consideration of water circulation in the pool, and the size and condition of the pool's pipework, the 2012 Report has recommended expenditure on pool water treatment plants that alone will have little or no impact on pool water quality.

5.0 OUR CONDITION ASSESSMENT OF THE POOLS

A well designed pool water treatment plant must have suitably placed pressure gauges and a flow meter in order to allow the Pool Plant Operator to identify adverse changes in water treatment plant performance.

None of Cleveland's pool water treatment plants have a flow meter or suitably placed and sized pressure gauges. As a result, the Pool Plant Operators, charged with the day to day running and long term maintenance of the plants, have had no opportunity to monitor plant performance. This has been further complicated by an almost total lack of "As Constructed" drawings for the pools and their water treatment plants. When you add to this mix a lack of adequate documentation for operation of the water treatment plants, it will come as no surprise that all of the pools in the Centre have substandard pool water quality. The lack of required equipment for monitoring plant performance together with little or no plant documentation is a common occurrence in public pools delivered by Design and Construct Contracts.

In an effort to establish the current performance of pool water treatment plants at the Cleveland Aquatic Centre, we engaged the services of a company that hires out portable flow meters together with an operator. Their equipment was used to quantify the flow in pipes when we carried out our review of the Facility's water treatment plants, details of which follow.

5.1 50 Metre Pool

5.1.1 Pool's Circulation Flow Rate

The volume of water in the 50 metre pool is approximately 1.52 megalitres. When this pool was designed, the turnover period (i.e. time taken for the pool's volume of water to pass through the water treatment plant) adopted would have been approximately 6 hours. While this turnover period still satisfies current Queensland Guidelines, it is significantly higher than current best practice of 3 to 4 hours. A pool water circulation flow rate of 70 litres per second (LPS) would be required for a 6 hour turnover, and 140 LPS for a 3 hour, best practice turnover.

During flow testing of the 50 metre pool's water treatment plant, prior to filter backwashing, the circulation flow rate was only 37 LPS, i.e. approximately half the flow rate required for a 6 hour turnover and only a quarter of the flow rate required for a 3 hour turnover.

5.1.2 Filter Backwash Flow Rate

We have estimated that a flow rate of approximately 90 litres per second would be required to backwash each cell of the pool's filter. When we started to backwash one cell of the 4-celled filter, we noticed that a valve, which had seized up open, was allowing approximately 50% of the 60 LPS recorded backwash flow to return to the pool. With only approximately 30 LPS of backwash flow passing through the filter cell, there is no way the sand bed was being fluidised, to release particles trapped in the bed. We therefore conclude that for some time now the 50 metre pool's filter bed has been blocked, rendering it entirely ineffective in filtering the pool's water, exposing pool users to potential health risks. We are also of the opinion that even when the faulty valve is fixed, the existing system of pipes and pump will not be capable of producing the required backwash flow of approximately 90 LPS.

5.1.3 Water Circulation in the 50 metre pool

Filtered and chemically treated water is returned to the 50 metre pool through numerous inlets uniformly spaced along the centreline of the pool's floor. Soiled water leaves the pool by flowing into channels located on both sides of the pool.

During our site inspection, we noticed that more water was flowing into the channel on the pool's north-eastern side than the south-western side. We also noticed that there was very little flow into the northern end of the pool's south-western channel. When the lack of uniform flow into both of the pool's side channels is combined with the pool's current turnover rate of approximately 11 hours, pool water quality could only be described as substandard, even if the filter were operating effectively.

There are several pipes connecting the 50 metre pool to its balance tank. During filter backwash, water is drawn from the pool's balance tank. If, during filter backwashing, water level in the balance tank drops too far, then a flow of water from the pool into the balance tank is activated by floats on pipes interconnecting the two bodies of water. Flow of water through those pipes has the potential to create an entrapment hazard for bathers in the pool. This is obviously an unacceptable risk.

5.1.4 Size and Condition of Underground Pool Pipes

The Pool Lessee has advised that the 50 metre pool is losing a considerable amount of water. Water loss could be from joints or cracks in the pool's concrete shell, or it could be from damaged underground pipework connecting the pool to its water treatment plant. It will be difficult to establish exactly where the water loss is taking place.

Council have advised that they have no drawings for the 50 metre pool. However, they have also advised that the pipe connecting the pool's balance tank to the water treatment plant is significantly larger in diameter than the 150mm diameter pipe that has been connected to that pipe to create a new pump suction. Whoever installed the new pump with a 150mm diameter pump suction had inadequate knowledge of the pool water treatment plant's operation as it will significantly limit that pool's water circulation flow rate.

5.2 20 Metre Indoor Pool

We understand that this pool experiences very heavy usage from young children being taught to swim. Young children often have low body fat requiring a pool water temperature of 33°C which is close to their body temperature of 36.9°C to prevent them from getting cold during a swimming lesson. They also have an immune system which is still developing, making control of the risk of infection from pool water more important than ever, particularly at an elevated temperature of 33°C.

5.2.1 Pool's Circulation Flow Rate

The volume of water in the Indoor Pool is approximately 130,000 litres. When this pool was constructed in 1988, it like so many other pools at that time would have been, most likely, designed for a pool turnover period of 6 hours, i.e. a circulation flow rate of approximately 6 LPS. If the pool were designed today, current best practice would have our office adopting a 1 hour turnover period, i.e. a circulation flow rate of 36 LPS. The 1 hour turnover period would be chosen in recognition of water temperatures of 33°C and a pool used by young, often incontinent, children for learn to swim, which necessitates improved water treatment to prevent outbreaks of rapid bacterial growth.

We have been advised that the pool's circulation pump was relatively recently replaced in an effort to increase the pool's circulation flow rate. A much larger replacement pump was chosen, based on a Council pool plan which detailed underground pipe sizes ranging from 80mm to 150mm in diameter. What the plan did not detail however was the fact that the 50mm diameter outlet pipes from the pool's skimmer boxes limit flow through each skimmer box to approximately 2 LPS to 3 LPS. The pool has 3 skimmer boxes which means that the 50mm diameter pipes on the skimmer boxes will limit pool water circulation flow rates to between 6 and 9 LPS. At these flow rates, the existing pump would be operating very inefficiently i.e. at approximately 50% efficiency instead of 75 to 80% which could have been achieved with a better choice of pump. The electricity cost associated with the pump inefficiency will be considerable, given the pump operates 24 hours a day, 7 days a week.

During flow testing of the Indoor Pool's water treatment plant, we were unable to obtain reliable flow readings using the portable flow meter. This was found to be due to an excessive quantity of air in the pool's pump suction. The most likely source of air is a break in the pool's underground pipework, as there were no signs of vortices (i.e. air intake) in the pool's skimmer boxes. When we used valves to restrict pool water circulation flow rate to approximately 6 LPS, air intake was reduced to a level that enabled a reliable flow meter reading. As detailed above, at a circulation flow rate of 6 LPS, the pool has a 6 hour turnover period which satisfies the 6 hour maximum turnover period recommended by the current Queensland Health Guidelines, but is significantly higher that the best practice required rate of 1 hour. Obviously the damaged pipe needs to be located and repaired as soon as possible.

5.2.2 Filter Backwash Flow Rate

The Indoor Pool has two 1200mm diameter sand filters. The minimum backwash flow rate that will be required to fluidise each filter's sand bed will be approximately 14 LPS. With the backwash water supplied from the pool via the pool's skimmer boxes, the required backwash flow will not be achieved.

5.2.3 Water Circulation in the Indoor Pool

Filtered and chemically treated water is returned to the Indoor Pool through 5 inlets spaced evenly along the pool's southern wall. Four of the inlets are located approximately 150mm below top water level and the fifth inlet approximately 500mm below top water level, midway along the pool's side wall. Assuming that each of the 5 inlets provide approximately even flow, with soiled water being removed by the pool's three skimmer boxes, located on the other side of the pool, there will be poor water circulation below the pool's surface water. This situation will create a potential health risk for pool users.

5.2.4 Size and Condition of Underground Pool Pipes

As discussed in Section 5.2.1 above, the 50mm diameter outlet pipes from the pool's skimmer boxes will restrict pool circulation flow rates to between 6 and 9 LPS. As a result, any upgrading of the pool's water treatment plant will provide only marginal improvement in pool water quality. The pool's existing filtered water inlets will also limit any possible improvement in pool water quality.

As also discussed in Section 5.2.1 above, there appears to be a break in the pool's underground pump suction pipework that requires fixing as soon as possible.

5.2.5 Pool Water Chloramines

Young often incontinent children urinate in a pool during learn to swim lessons. Ammonia in the urine reacts with chlorine in the pool's water to create chloramines. Chloramines are responsible for the heavy smell of chlorine, often associated with indoor pools. Chloramines are effectively trapped in poorly ventilated indoor pools, like the one at the Cleveland Aquatic Centre, and have been proven to adversely affect the health of both users and staff who regularly frequent Indoor Pools. This health risk can be minimised with a combination of ultra violet treatment of pool water and good ventilation within the pool's enclosure. The Indoor Pool has neither of these available.

5.3 25 metre Pool

5.3.1 Pool Circulation Flow Rate

The volume of water in the 25 metre pool is approximately 357,000 litres. When this pool was constructed in 1994, it like so many other pools at that time would have been, most likely, designed for a pool turnover period of 6 hours i.e. a circulation flow rate of approximately 16 LPS. If the pool were designed today, as a learn to swim pool, current best practice would have our office adopting a pool turnover period of 1.75 hours i.e. a circulation flow rate of approximately 56 LPS.

We have been advised that the pool's circulation pump was replaced relatively recently. A larger pump was chosen. It appears that the larger pump was chosen in an effort to increase the pool's circulation flow rate to approximately 40LPS.

During flow testing of the 25 metre pool's water treatment plant, prior to filter backwash, the pool's circulation flow rate was approximately 15 LPS. After backwashing the filters, flow increased to approximately 16 LPS. These flow rates confirm that the larger replacement pump has not successfully increased the pool's circulation flow rate. The apparent poor choice of pump has been an expensive mistake, not so much because of the increased cost of a larger pump, but because the larger pump will be more expensive to run 24 hours a day, 7 days a week.

5.3.2 Filter Backwash Flow Rate

The 25 metre pool has three 1200mm diameter sand filters. We understand that, just prior to our site inspection, Zeolite media in the three filters was removed and replaced with a grade 7M sand supplied by River Sands. The Pool Lessee advised that at the time of replacement, the top of the Zeolite bed was clogged. This clogging was, in our experience, to be expected. Zeolite is a biological filter media which should never be used as a replacement for a granular filter media (i.e. sand). During the recent media replacement, one of the three filters was found to be damaged and at the time of our site inspection was still awaiting replacement.

The installed sand filters will require a backwash flow rate of approximately 14 LPS. When we attempted to backwash each of the filters separately, the maximum backwash flow rate recorded by the portable flow meter was 7.5 LPS, significantly lower than the 14 LPS backwash flow rate required. At a backwash flow rate of 7.5 LPS the filters sand bed will not fluidise to allow the release particles trapped in the bed. In a short period of time, the filter's new sand beds will become clogged and there will be virtually no filtration of the pool's water. This situation will create a potential health risk for pool users.

On closer inspection of the filters, we noticed that they all have 50mm diameter multi-port valves. Manufacturers of this size valve typically specify their maximum flow rate of approximately 8 LPS. Installation of filters with multi-port valves, that are too small to allow the filters to be adequately backwashed is not uncommon, in our experience with reviewing pools delivered by Design and Construct contracts. Currently 50mm multi-port valves sell for approximately $300 whereas 80mm valves, required to allow adequate 1200mm diameter filter backwash, sell for $1200.

5.3.3 Water Circulation in the 25 metre Pool

Filtered and chemically treated water is returned to the pool through 10 wall mounted inlets along the pool's western side wall, 8 wall mounted inlets along the pool's eastern wall and 5 evenly spaced inlets located along the centreline of the pool's floor. Unfortunately Council do not have any drawings detailing the pool's underground pipework which connects the pool to its water treatment plant. At the time of our inspection, no flow could be detected from several of the pool wall inlets.

Soiled water leaves the 25 metre pool through 4 skimmer boxes mounted on each side of the pool. With 18 of the pool's 23 filtered water inlets located on the pool's side walls, almost directly below skimmer boxes, filtered water entering the pool through those inlets will flow straight up to the nearest skimmer box, providing little or no improvement in pool water quality. This is obviously not desirable.

5.3.4 Size and Condition of Underground Pool Pipes

Unfortunately Council do not have any drawings detailing underground pipework connecting the pool to its water treatment plant. However we do know that the skimmer boxes installed typically have a 50mm diameter pipe connection which limits flow from each skimmer box to between 2 and 3 LPS. As a result, with 8 skimmer boxes, pool water circulation flow rate will be limited to between 16 and 24 LPS (i.e. a turnover period of between 2.25 and 1.5 hours).

5.4 Outdoor Spa

5.4.1 Spa Circulation Flow Rate

The volume of water in the Spa is approximately 4,400 Litres. During flow testing of the Spa Pool's water treatment plant, prior to filter backwash, the circulation flow rate was approximately 5.8 LPS. At this flow rate, the Spa has a turnover period of approximately 13 minutes, which is less than the 20 minutes minimum requirement of the current Queensland Health Guidelines.

5.4.2 Filter Backwash Flow Rate

The Spa has a single 1200mm diameter sand filter. The installed sand filter will require a backwash flow rate of approximately 14 LPS, and during a minimum backwash of 3 minutes will require 2,800 litres of water which is approximately 65% of the Spa's water volume. When we attempted to backwash the Spa's filter, the maximum flow rate recorded by the portable flow meter was 6.6 LPS. At that backwash flow rate, the filter's sand bed will not fluidise to allow the release of particles trapped in the bed. This situation will create a potential health risk for spa users.

5.4.3 Water Circulation in the Spa

With the Spa having a relatively small volume of water, it is unlikely that the circulation of water in the Spa will be inadequate.

5.4.4 Size and Condition of Underground Pipes

The pipes connecting the Spa to its water treatment plant appeared to be in good working order. They are, however, inadequately sized to provide the required filter backwash flow rate to the installed sand filter.

5.5 Rapid River

We have been advised that when the two pumps that have been installed to circulate water in the Rapid River are in use, flow in the pool is excessive with reports of pool users being injured. As a result, we have been advised that only one pump is ever used.

During flow testing of the Rapid River's water treatment plant, repairs were being carried out on the pools underground suction pipework. As a result, we were unable to carry out any flow tests on the Rapid River's water treatment plant.

5.6 Leisure Pool

"As Constructed" drawings for the Leisure Pool show that the pool was originally designed to be two pools, a Toddler's Pool and a Leisure Pool.

5.6.1 Pool Circulation Flow Rates

"As Constructed" drawings appear to show the Toddler Pool and Leisure Pool have separate pool water circulation pipework. We have been advised that the two pipe networks have since been combined into a single pipe network, in an effort to overcome a problem with priming the Toddler's Pool circulation pump due to air intake on the suction pipe work. This arrangement is far from ideal as we understand it has not eliminated the air intake. Air in pipework and filters will compromise their efficient operation.

During flow testing of the Leisure Pool's water treatment plant, the circulation flow rate was approximately 26 LPS. At this flow rate, the pool will have an approximate turnover period of 2.7 hours. Although this turnover period is less than the 6 hours required by current Queensland Health Guidelines, it is significantly higher than best practice turnover times of 10 to 45 minutes for leisure pools less than 0.5 metres deep, and 1 to 3 hours for leisure pools 1 to 1.5 metres deep.

5.6.2 Filter Backwash Flow Rates

The recorded filter backwash flow rate of 19 LPS appears to be adequate to fluidise the sand beds of the three installed 1200mm diameter sand filters.

5.6.3 Water Circulation in the Leisure Pool

On the "As Constructed" drawings, the Toddler's Pool has 2 skimmer boxes located on the southern side of the pool to take soiled pool water to the water treatment plant and four floor mounted inlets, located on the western side of the pool to return filtered and chemically treated water back to the Toddler's Pool. With this arrangement, the eastern half of the Toddler's Pool will have inadequate pool water circulation, potentially exposing pool users to health risks.

On the "As Constructed" drawings, the Leisure Pool has 6 skimmer boxes, two located on the pools southern side and four located on the western side. Filtered and chemically treated water is returned to the pool through pool floor inlets and water features positioned around the pool.

5.6.4 Size and Condition of Underground Pool Pipes

As discussed in 5.6.1, we have been advised that air is being drawn into the pipework through the Toddler's Pool pump suction line. We understand that the source of this leak is not known. Locating and repairing the broken pipe which is allowing air intake will require uncovering most, if not all, of the Leisure Pool's underground circulation pipework. This will most likely be difficult and therefore expensive. The Leisure Pool's "As Constructed" Drawing Number TAY 14310/501, Revision A has a Section A taken through a trench of pipes that have been stacked one on top of the other. The trench has three layers of pipes, with pipework for the Leisure Pool on the bottom. In our experience, poor construction standards like this are common in Design and Construct Contracts for Council Pools, and make access for pipe maintenance understandably difficult.

6.0 REQUIRED IMMEDIATE MAINTENANCE

As detailed in Section 5 of this report, all pools in the facility have significant problems with pool water quality, exposing pool users to potential health risks. To reduce those risks, we strongly recommend that immediate maintenance work be carried out as follows.

6.1 Outdoor 50 metre Pool

Immediate maintenance should include the following:

- Replace seized valve
- Increase diameter of pump suction pipework
- Increase diameter of pump discharge pipework
- Check condition of sand in filters and replace if necessary
- Install flow meter and pressure gauges to allow monitoring of plant performance

6.2 Indoor 20 metre Pool

Immediate maintenance should include the following:

- Repair pipework to eliminate air intake into pump suction
- Check condition of filter media and replace if necessary
- Install temporary above ground tank to provide water for filter backwash
- Install flow meter and pressure gauges to allow monitoring of plant performance

6.3 Outdoor 25 metre Pool

Immediate maintenance should include the following:

- Replace sand filters
- Upgrade filter pipework and valves
- Install flow meter and pressure gauges to allow monitoring of plant performance

6.4 Outdoor Spa

Immediate maintenance should include the following:

- Install pressure gauges to allow monitoring of plant performance
- Remove existing sand filter and replace with a cartridge filter

6.5 Rapid River

Immediate maintenance should include the following:

- Install flow meter and pressure gauges to allow monitoring of plant performance
- Check for air in suction pipework and repair pipework if required
- Confirm pump is maintaining prime

6.6 Leisure Pool

Immediate maintenance should include the following:

- Install flow meter and pressure gauges to allow monitoring of plant performance.
- Locate and repair broken suction pipe to eliminate air intake

6.7 Cost Estimate for Immediate Maintenance

Our cost estimate for the items detailed in this section of the Report as requiring immediate maintenance are as follows:

Cost estimate of work	$150,000
Contingency	$ 50,000
Specialist Pool Engineering (20%)	$ 40,000
TOTAL COST ESTIMATE	$240,000

7.0 REQUIRED UPGRADES

7.1 Upgrades required within 3 years (Stage 1)

Following completion of the immediate maintenance recommended in Section 6 of this report, we anticipate that the Outdoor Spa, Rapid River, Leisure Pool and 25 metre Pool will satisfy current Queensland Health Guidelines. The indoor 20 metre and outdoor 50 metre pool however are in such relatively poor condition that if their use within the Facility is important, then they should be replaced as soon as possible. If as we suspect, this is required, then that process, at best, is likely to take 2 to 3 years and cost approximately $6M to $7M.

7.2 Upgrades required within 3 to 7 years (Stage 2)

With the new Indoor Pool and Outdoor 50 metre Pool completed, Council should next address replacement of the facility's 25 metre Outdoor Pool. We estimate that replacement of the 25 metre outdoor pool will cost $3M to $4M.

7.3 Upgrades required within 7 to 10 years (Stage 3)

The facility's final upgrade will involve replacement of the entry and amenity buildings (e.g. change rooms, swim club room, gymnasium etc.) along with the provision of new leisure water attractions to replace the existing Spa, Rapid River and Leisure Pool. An upgrade of the car park will also be required. Given that there are no details for that work, we are unable to provide a cost estimate.

8.0 REQUIRED MASTER PLAN

Before commencing the design for replacement pools within the Facility, it will be important that a Facility Master Plan is prepared by a suitably qualified and experienced Architect. Strategic Leisure and our office should be engaged to assist the Architect with preparation of the Master Plan in an effort to ensure the Master Plan satisfies facility and pool operational issues. The Master Plan will need to address amongst other things the following important criteria:

- Stage 1 of the facility's redevelopment is recommended to be the removal of the Indoor 20 metre Pool and Outdoor 50 metre Pool. Given the Cleveland Aquatic Centre is Council's only mainland aquatic centre, we anticipate that a new 50 metre pool will be required. We also anticipate that a new indoor pool, with water heated to 33°C will be required, to accommodate learn to swim classes and exercise by the elderly and the infirmed. This pool should also have an entry ramp. When these pools are removed and replaced, the existing Spa, Rapid River, Leisure Pool and 25 metre Pool should provide reasonable temporary aquatic opportunities for the Redland Bay Community.
- Stage 2 of the facility's redevelopment would involve replacement of the existing 25 metre pool with a new 25 metre pool. The proposed Master Plan will need to consider the provision of access to the new indoor and 50 metre pools while the 25 metre pool is replaced.
- Stage 3 of the facility's redevelopment would involve replacement of the facility's entry and amenity buildings (e.g. change rooms, swim club room, gymnasium etc.). Also included in Stage 3 would be removal of the Spa, Rapid River and Leisure Pool and replacement with a Splashpad or similar leisure water attraction. An upgrade of the car park will also be required.