J.H. COCKERELL PTY LTD
Specialist Pool Engineers

J.H. COCKERELL PTY. LTD.
CONSULTING ENGINEERS
ACN 010 075 564
ABN 72 226 534 268

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

PREPARED BY

J.H. Cockerell Pty Ltd
Consulting Structural & Hydraulic Engineers
Level 2 / 170 Alfred Street
Fortitude Valley
Brisbane Qld 4006
Ph: (07) 3852.1041
Fax: (07) 3252.4201

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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 2 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.

Angela Wright

From: Tim Goward
Sent: Wednesday, 9 July 2014 10:32 AM
To: Angela Wright; Kristina Dickman; Lex Smith
Subject: Cockerell Report
Attachments: 2014 05 09 Updated Condition Assessment and Maintenance Plan (2).pdf

Morning all,

Please find attached Cockerell Report for the Cleveland Aquatic Centre. Cost estimates have come in $6-$8 million for the replacement of the 50m and 20m teaching pool. Some assumptions were made in terms of electrical which with a major redevelopment may require addressing which was out of scope from this report. The report also makes recommendation for a masterplan of the site which I believe is the way forward at which time Council would be able to gauge better cost estimates.

For discussion with Gary tomorrow at 11.00am.

Tim Goward
Senior Sport and Recreation Officer
Sport and Community Facilities
Redland City Council
Ph: (07) 3829 8751
Mb: [redacted]

30 April 2020

Sven Ljungberg
Program Manager City Infrastructure
Redland City Council
PO Box 21
Cleveland Qld 4163

Our ref: 12529667-91670-1
Your ref:

Dear Sir

Redland Pool Refurbishment Investigation
Structural Check of Pool Walls

GHD are engaged by the Redlands City Council (RCC) to investigate and provide solutions to the leaking 50 m pool at the Cleveland Aquatic Centre.

As part of the immediate repair being undertaken by RCC, the pool may be emptied which will result in soil pressure acting on the wall without the balancing effect of the water inside.

To ensure that the wall is structurally adequate for the pool empty condition, GHD has undertaken a check of the wall and the slab.

The following parameters were used in the structural check

- Soil density 2000 kg/cu m
- Soil property (internal friction angle) – 30 deg
- Active soil pressure (Ka=0.333) and material reduction factor = 0.9 (AS 4678 - Earth Retaining Structures)
- Live load behind wall (on concourse) = 1.5 kPa (150 kg/sq m)
- No ground water
- Walls are vertical cantilevers and not propped horizontally at the top
- Concrete grade f'c = 25 MPa
- Australian Standard AS 3735 – Concrete Structures for Retaining Liquids was used in the check. Load is assumed to be a short term condition - Group B loading.
- Structural information was obtained from John Wilson & Partners drawings B14639, B14641, B14642, B14643, B14644, B14645, B14646 & B14650

Results of the structural check are listed in the table below

	REINFORCEMENT STEEL STRESS			
LOCATION	Steel Stress in Wall & Slab Reinforcement (MPa)	Maximum Allowable Steel Stress according to AS 3735 (MPa)	Horizontal Deflection at top of wall (mm)	Comments
Side wall at deepest location	105	162	13	20 mm dia. bar
Side wall at location of 16 mm dia. bar	87	175	Less than above	16 mm dia. bar
End wall	60	187	Less than above	12 mm dia. bar

From the results, the wall and slab are structurally adequate to resist the soil & live loads when the pool is empty provided

- Live load behind the wall is limited to 1.5 kPa (150 kg/sq m)
- No ground water. The Redlands Shire Council must monitor the ground water level to ensure that both the floor slab and wall are not subjected to hydrostatic pressure. Under conditions where the water table rises above the bottom of the slab (at its lowest point) then the pool must be immediately filled with water.

Note that there may be some movement between the top of the wall and the concourse slab resulting in the joint between the two slightly opening. There may be some differential movement between the vertical wall joints. These movements have no structural consequences.

There will also be some horizontal deflection at the top of the wall which may result in detachment of some tiles at the base of the wall, however, this is not a structural defect.

It is not permitted to have vehicles move along the concourse when the pool is empty. As a precaution we recommend RCC inspect the pool daily for any sign of excessive movement when it is empty and the pool is not left empty for longer than necessary. Long empty periods will allow the drying and shrinking of the concrete causing possible leakage when refilled.

We note that the pool does not have a hydrostatic relief valve. While anecdotally the sub-floor drainage appears to work satisfactorily but if left empty for a prolonged period (months) then heavy prolonged rain could overwhelm the capacity of sub-floor drains causing a heave of the base slab.

Please do not hesitate to contact GHD if you have any queries with the above.

Sincerely
GHD

Senior Structural Engineer

Memorandum

21 May 2020

To	Redland City Council		
Copy to	Mr S.Lunjberg		
From	[redacted]	Tel	[redacted]
Subject	Joint repair and pipe testing	Job no.	12529667

Background

Following emptying and cleaning of the pool which became necessary in order to repair the known leak in the return line to the plant room, and inspection by GHD engineers was carried out on 14 May 2020 to assess the following:

- Signs of any movement of the pool wall after emptying
- General condition of the shell and tiling
- Condition of the shell floor and wall joints

This inspection process was not in the initial inspection methodology but quite advantageous as it provided the opportunity to complete a detailed survey to assess what appears to be a shell and tile finish that is in quite reasonable condition by visual and testing on a scale and means that is not possible with the filled pool. Filling the pool is a very expensive exercise and not planned to be repeated during the current refurbishment.

The downside of emptying the pool is that an initial dye injection leak test of the joints by divers was not done. Leaks may still be present in other parts of the pool shell which will not be picked up until confirmatory leak testing is done with a full pool and remade joints. As noted below, the joint caulking is at the end of its service life so pre-emptive testing may have been a moot exercise.

Wall movement

The concrete concourse has a joint just behind the wall scupper gutter and so forms a reasonable monitoring point to check that earth pressure on the pool wall has not excessively loaded the wall and pushed it in. Tapping of the concourse indicates frequent hollowness under the slab most likely due to uncontrolled fill. This settlement would generate significant earth pressure against the wall.

Photo 1 below shows the maximum extent of movement in this joint. This movement of 2 -3 mm cannot positively be attributed to wall movement as similar joint sealant gaps were found at the pool corners, where the corner buttressing would not allow the shallow walls to move in. The sealant gap could arise from a variety of causes but at least now a benchmark measurement has been established.

Another measure of wall movement is out of plane movement when looking along the wall. Again sighting along the wall proved inconclusive. Although very slight bowing of the wall could barely be

GHD Pty Ltd ABN 39 008 488 373
Level 9 145 Ann Street Brisbane Queensland 4000 GPO Box 668 Brisbane QLD 4001 Australia
T +61 7 3316 3000 **F** +61 7 3316 3333 **E** bnemail@ghd.com **W** www.ghd.com

detected by eye (refer photo 2) it was not of a magnitude for concern. Tapping of tiles at the base of these bowed sections found no damage.

Photo 1 Gap between concourse and pool wall

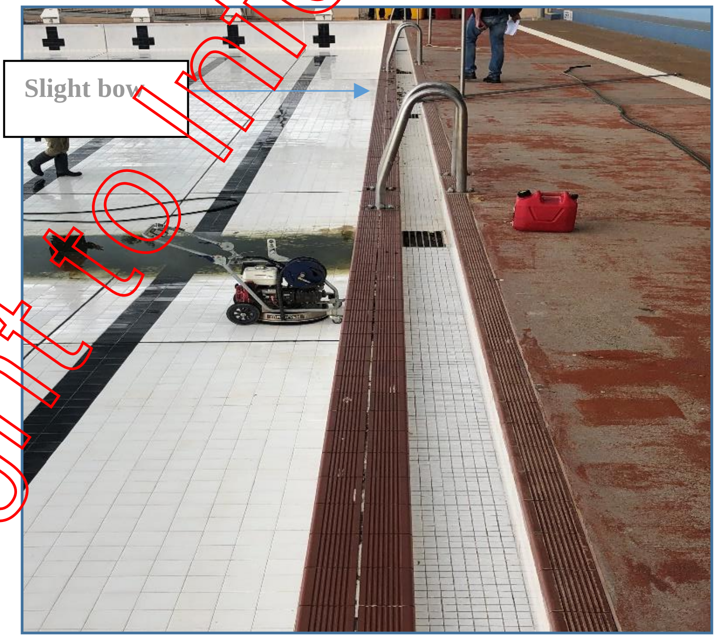

Photo 2 Slight bow in southern wall line

GHD Pty Ltd ABN 39 008 488 373
Level 9 145 Ann Street Brisbane Queensland 4000 GPO Box 668 Brisbane QLD 4001 Australia
T +61 7 3316 3000 **F** +61 7 3316 3333 **E** bnemail@ghd.com **W** www.ghd.com

Condition of Pool Shell And Tiling

The condition of the pool shell is critically important for the long term viability of the pool as it is the one element that cannot be replaced and its ongoing repair would represent a very disruptive high cost. The condition of the tiled finish is a fair indicator of the structural condition of the underlying concrete as cracking and spalling would be reflected in the brittle tiles. Cracked tiles are an unacceptable risk in a pool as the crack edge is invariably extremely sharp. No cracked tiles were found in the pool floor although some were chipped.

Notwithstanding the hollowness beneath the concourse slabs indicating some settlement of soil beneath, no signs of ground movement in the concourse or pool shell was found. No differential movement across joints was found. The north east corner end wall has approximately 2 sq m of drummy tiles and a crack that was noted before the pool was empty. No discernible reason for this drumminess other than potentially tile growth, was found.

In small isolated areas of the floor 2- 6 tiles are drummy, often being ones already replaced, possibly indicating defective original installation and difficulty in relaying underwater. Tiles along the return floor jets are all sound. One area had 3 missing tiles showing sound concrete below. In isolated cases there were individual chipped or broken tiles arising from operational use. Overall the tiling was in good condition for a public facility in the order of 50 years old. With maintence now to replace drummy and chipped tiles, the shell would be expected to continue to give good service for the foreseeable future. Photo 3, 4, 5 below show typical areas of tile defect that are easily made good.

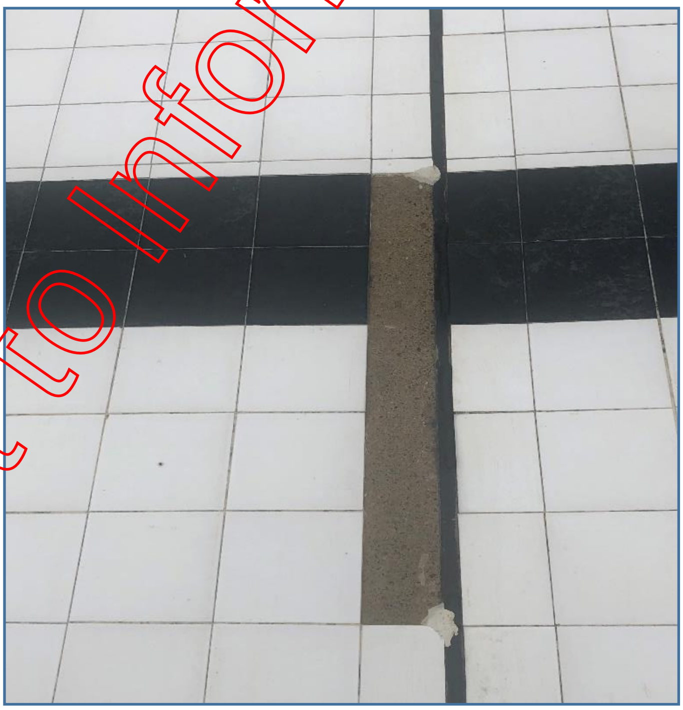

Photo 3 Short length of missing tiles, sound concrete beneath

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Level 9 145 Ann Street Brisbane Queensland 4000 GPO Box 668 Brisbane QLD 4001 Australia
T +61 7 3316 3000 **F** +61 7 3316 3333 **E** bnemail@ghd.com **W** www.ghd.com

Photo 4 Repaired tile areas are often drummy

Photo 5 Chipped tiles have sharp edges

GHD Pty Ltd ABN 39 008 488 373
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T +61 7 3316 3000 **F** +61 7 3316 3333 **E** bnemail@ghd.com **W** www.ghd.com

Memorandum

Floor And Wall Joints

A significant bonus in determining overall condition of the pool was the ability to closely inspect the floor and wall joints in the empty pool. The wall joints have the added protection of a PVC water stop cast in across the joint in addition to the surface mastic seal. The floor joints relay on a 40 mm deep bituminous seal, most likely poured in as a hot mix. The history of joint maintenance is unknown although it looks as if several areas of the wall joint have had some replacement sealant installed, it is possible the floor joints have the original material.

Anecdotally, it appears that at least one leak source within the pool was pressure or level dependant. As the pool was naturally draining down, the outlet of the under shell agg drains stopped running with about 600 mm of water still in the pool. This does suggest a fault in the joint sealant somewhere as the agg drains are located directly beneath the joints.

The issue with joints is that they will all be of a similar age and condition. A failure in one location is indicative that the entire system is at the end of reliable life. The lack of observed movement around the pool indicates that excessive movement across the joint is not a contributing factor and the very long time between recaulking discounts poor workmanship or joint material. No sign of concrete spalling was found at any joint. The joints are structurally sound, the caulking material is just at the end of its reliable working life.

It was noted that pressure cleaning the walls had dislodged some of the wall mastic. It would be expected that mastic above the splash zone would dry and weather more quickly than material below the waterline. The bituminous floor calking was brittle to a depth of around 20 mm with some necessary elasticity remaining in the depth below. Whether 20 mm of slightly mastic bitumen is sufficient to retain 20 Kpa of water pressure is not calculable. All that can be said is that the floor joints are consistently now not in accordance with the original specification which had proved to be adequate for several decades.

Pipe Testing

The empty pool provides an opportunistic time to leak test the piped systems leading to and from the balance tank. Although the scupper drains are only under gravity pressure, as noted above, tapping the concourse slabs indicated the ground beneath has settled away from the slab soffit. Backfill just behind the pool wall would be uncompacted and likely to settle over time. The pipe material used at the time of construction is likely to be quite brittle. The pressure testing will indicate which pipes may require further examination with a camera. Attachment A is an annotated extract from the design drawings showing which pipes are to be tested and notes on the procedure.

GHD Pty Ltd ABN 39 008 488 373
Level 9 145 Ann Street Brisbane Queensland 4000 GPO Box 668 Brisbane QLD 4001 Australia
T +61 7 3316 3000 **F** +61 7 3316 3333 **E** bnemail@ghd.com **W** www.ghd.com

Memorandum

Recommendations

Given that no structural defects were found in the pool shell and no ground movement was observed to be affecting the shell, it is recommended that a detailed trade based inspection of the tiled finishes be carried out with all drummy, cracked and chipped tiled to be replaced. When the 2 sqm of tiles are removed in the NE corner wall, this office be requested to inspect the concrete substrate before retiling. Note that after replacing the jointing there remains the possibility of leaks in other locations of the pool system. Pipe pressure testing and dye testing of the joints will confirm the integrity of other areas. Pipes to and from the balance tank should be tested now while the pool is empty.

All floor and wall mastic jointing must be replaced. A separate drawing and specification for this work will be issued to allow calling of tenders for this work.

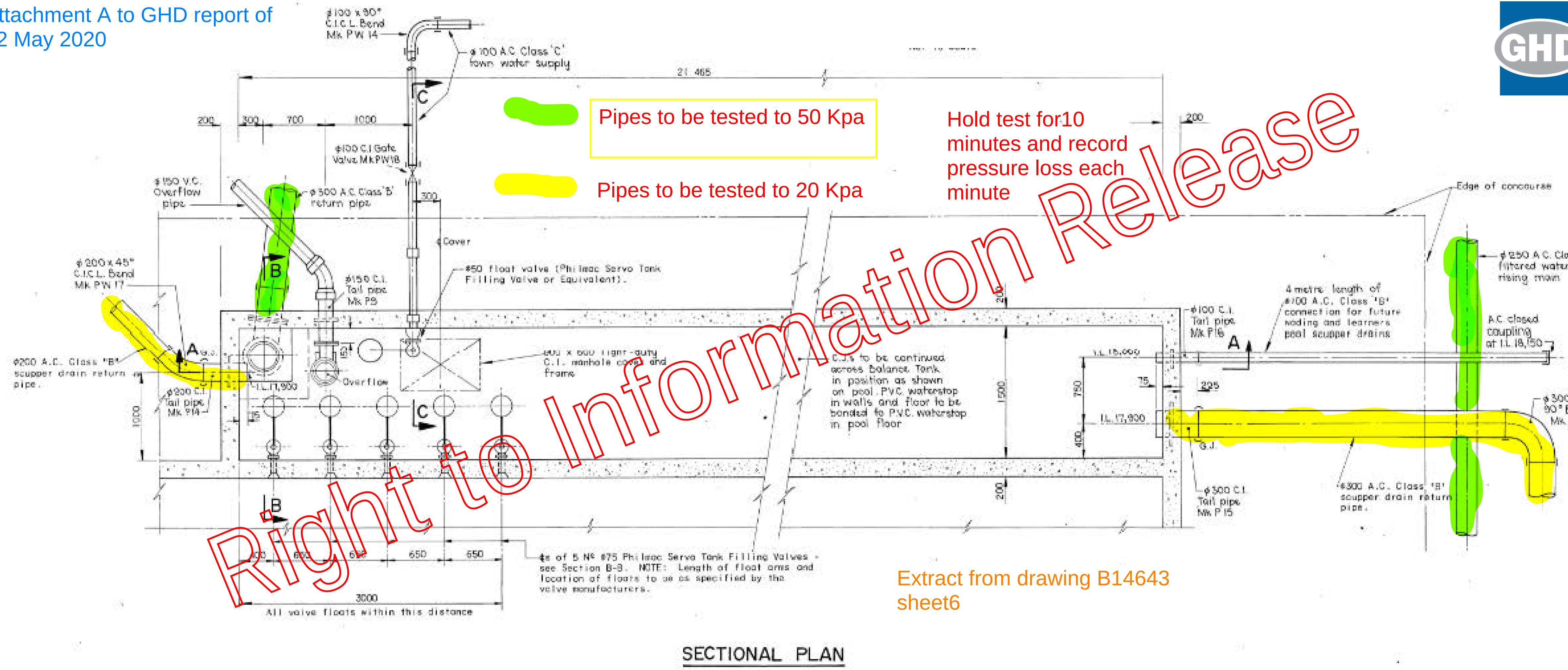
Regards

Technical Director Structures RPEQ

Attachment A Balance tank pipework to be pressure tested

GHD Pty Ltd ABN 39 008 488 373
Level 9 145 Ann Street Brisbane Queensland 4000 GPO Box 668 Brisbane QLD 4001 Australia
T +61 7 3316 3000 **F** +61 7 3316 3333 **E** bnemail@ghd.com **W** www.ghd.com

Attachment A to GHD report of 22 May 2020



Extract from drawing B14643 sheet6

JH Cockerell Pty Ltd
(07) 3852 1041
info@jhcockerell.com
www.jhcockerell.com

CONDITION ASSESSMENT & MAINTENANCE COSTS

FOR

CLEVELAND AQUATIC CENTRE

(July, 2021)

FINAL

PREPARED BY

J.H. Cockerell Pty Ltd
Consulting Structural & Hydraulic Engineers
Level 2 / 170 Alfred Street
Fortitude Valley
Brisbane Qld 4006
Ph: (07) 3852.1041

This Report on the pool water treatment plants at the Cleveland Aquatic Centre:

- *Has been prepared by JH Cockerell Pty Ltd (JHC) for Redland Bay City Council:*
- *May only be used and relied on by Redland Bay City Council:*
- *Must not be copied to, used by, or relied on by any person other than Redland Bay City Council without the prior written consent of JHC;*

JHC and its employees expressly disclaim responsibility to any person other than Redland Bay City Council arising from or in connection with this Review.

The limited services undertaken by JHC in connection with preparing this report are as follows:

- *Inspect the pool water treatment plants at the Cleveland Aquatic Centre and report on their condition making reference to JHC's 2014 "Updated Pool Condition Assessment and Maintenance" where there is relevance.*
- *Estimate Cleveland Aquatic Centre's pool water treatment plant maintenance costs for the next 10 years.*

The opinions, conclusions and any recommendations in this Review are based on assumptions made by JHC when undertaking services and preparing the Report;

JHC expressly disclaims responsibility for any error in, or omission from, this Review arising from or in connection with any of the assumptions being incorrect;

Subject to the paragraphs in this section of the Report, the opinions, conclusions and any recommendations in this Report are based on conditions encountered and information reviewed at the time of preparation;

Non-conformances associated with statutory building regulations (BCA), Disabled Access Provisions (DDA), Work Place Health and Safety (WH&S), AS3000 Wiring Rules and Earthquake Loading Code AS1170.4 requirements have not been identified and assessed;

Where the extent of work is not known or where technical difficulties may be evident, fees may be indicated for detailed investigation and identification of the problem for use in subsequent budget periods.

TABLE OF CONTENTS

Document control

Issue	Description	Date
P1	Preliminary Draft	25/5/2021
P2	Preliminary Draft	25/6/2021
	Final	23/7/2021

1.0 INTRODUCTION

1.1 Commission

The Cleveland Aquatic Centre has the following five pools:

- Outdoor 50 metre pool
- Indoor 20 metre pool
- Outdoor 25 metre pool
- Rapid river pool
- Leisure pool

Consulting Engineers J.H. Cockerell Pty Ltd (JHC), who have over 40 years experience in designing public pools and their water treatment plants, have been commissioned by Council to:

- Inspect the pool water treatment plants at the Cleveland Aquatic Centre and report on their condition, making reference to JHC's 2014 "Updated Pool Condition Assessment and Maintenance", when relevant;
- Provide cost estimates for required capital expenditure on pools at the Cleveland Aquatic Centre for the next 10 years.

Visual inspections were carried out by J.H. Cockerell's Mr Allan Cockerell, in an effort to identify and document pool water treatment plant defects and required capital expenditure on pools for the next 10 years.

1.2 Pool Water Quality

Council Pool Users 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 JHC's experience of having reported on the condition of over 100 Council pools and their water treatment plants, this assumption particularly with regard to pool water quality is nearly always incorrect.

It is often thought that State Government Guidelines for Pool Water Quality provide the design standards for public pool water treatment plants. They don't. The Guidelines were written for use by the Operators of public pool water treatment plants. In JHC's experience, the Operators are often unable to consistently provide pool water quality in accordance with the Guidelines, because of inadequacies in the design of the pool water treatment plant. Australia's lack of Standards for the design of public pool water treatment plants and equipment in those plants exposes pool users to a wide range of health risks including the following:

1.2.1 Pool Water Pathogens

Most pool users are aware of health hazards associated with pathogens in pool water. Few are aware of the range of pathogens that create a potential health risk which include the following:

Viruses

- Adenoviruses
- Hepatitis A
- Noroviruses
- Enteroviruses
- Molluscipoxvirus
- Papillomavirus

Bacteria

- Shigella spp
- E. coli 0157
- Legionella spp
- Pseudomonas spp
- Mycobacterium spp
- Staphylococcus aureus
- Leptospira spp

Protozoa

- Giardia
- Cryptosporidium
- Naegleria fowleri
- Acanthamoeba spp
- Plasmodium spp

The most vulnerable to the above health risks, caused by pool water pathogens, are children under 6 years old whose immune systems are still developing and the elderly who often have a compromised immune system.

1.2.2 Pool Water Chlorine By-Products

Few pool users are aware of the health hazards associated with chlorine by-products. Most public pool users will have smelt what they thought was chlorine at pool venues, without understanding that the smell is not chlorine but chlorine by-products. Chlorine by-product gases are 4 times heavier than air and are created when chlorine reacts with nitrogen compounds in pool water. Those gases have health risks including the following:

- Research has linked the use of indoor pools with scoliosis - curvature of the spine.
- Promotion of asthma.
- Increased incidence of hay fever & rhinitis which is inflammation of the mucous membrane in the nose.
- Skin and eye irritation. The skin irritation is typically contact dermatitis.

Chlorine mixed with clean water does not smell of chlorine.

Those most vulnerable to the above detailed health risks, caused by chlorine by-products in pool water, include the following:

- Children under 6 years old, with developing neural pathways and respiratory systems, while learning to swim.
- The elderly who often have a compromised respiratory system.
- Learn to swim teachers whose respiratory systems are exposed to the gases for several hours a day.
- Lap swimmers whose respiratory systems are exposed to the gases during lengthy training sessions.

1.2.3 Standards & Guidelines for Public Pool Water Quality

The difficulty with pool water hygiene is that pathogens and chlorine by-products are not visible to the naked eye and as a result often pass unnoticed. When a pool user experiences a health problem caused by substandard pool water quality, it is usually several days after pool use, making it unlikely they will associate their health problem with pool use. Even when they do think their health problem has been caused by pool use, it has been difficult, if not impossible, to prove in all cases except when it is from cryptosporidium. Fortunately, change is under way with new technology now making identification of substandard pool water quality much easier and relatively inexpensive.

The German standard DIN19643 is the only standard in the world that adequately addresses all aspects of design, construction and operation for public pool water treatment plants. DIN19643 has been successfully used for the design, construction and operation of many European pools for over 20 years. Many European Countries have largely adopted the DIN19643 standard.

Queensland Health's document "Water quality guidelines for public aquatic facilities – Managing public health risks" was updated in 2019 to include the following:

- DIN19643
- A statement that "Effective filtration is essential pre-treatment to effective chlorination".
- The Guidelines nominate daily turbidity testing of pool water, in an effort to confirm effective filtration.

Although the updated Queensland Health Guidelines were published over 18 months ago, daily turbidity tests have not been, to date, carried out on any of the five pools at the Cleveland Aquatic Centre.

It is important for Councils to understand that Courts of Law, when considering risks and reasonably foreseeable damage/injury/illness associated with water quality in public pools, will consider best current practice, not just guidelines, before apportioning liability and compensation between pool owners, contractors and consultants.

1.3 Useful Life of a Municipal Pool

Municipal pool water treatment plants designed, constructed and operated in accordance with DIN19643, can be expected to have a relatively trouble free, useful life of 50 years. Water treatment plants for most Australian municipal pools have not been designed or manufactured in accordance with DIN19643. This is the case for the 5 pool water treatment plants at the Cleveland Aquatic Centre, creating a range of health risks for pool users. As detailed in JHC's 2014 Report, copy of which has been attached in Appendix E, "immediate maintenance" was required to reduce those health risks. Most of the required pool water treatment plant maintenance has either not been undertaken or been undertaken to an unacceptable standard. To eliminate health risks, all the water treatment plants must be replaced by plants designed, constructed and maintained in accordance with DIN19643.

Municipal pools designed and constructed in accordance with relevant Australian standards, can be expected to have a relatively trouble free, useful life of 50 years. The only pool at the Facility that may have been designed and constructed in accordance with relevant Australian standards is the 50 metre pool. The 50 metre pool's concrete shell may have been designed in accordance with AS3735 Concrete structures for retaining liquids. However, it is unlikely that the pool's tiles were selected and installed in accordance with any standard. As a result, pool tile maintenance has been expensive. Every 4 or 5 years Council spends over one hundred thousand dollars on tile maintenance, in an effort to prolong the life of the pool's tiled finish.

JHC's 2014 Report recommended that all the Facility's pools be replaced over the next 3 to 10 years ie between 2017 and 2024. To date, none of the pools have been replaced.

2.0 INSPECTIONS OF POOL WATER TREATMENT PLANTS

Prior to undertaking site inspections, JHC requested copies of the "Operation & Maintenance Manual" for each of the pool water treatment plants. To date, none have been provided.

JHC has carried out several site inspections, in an effort to identify the following:

- Whether maintenance has been carried out on the Facility's pool water treatment plants, in accordance with the recommendations of JHC's 2014 Report.
- Whether that maintenance has been carried out to a reasonable standard.

2.1 Pool Water Treatment Plant - Filters

2.1.1 Ineffective Filters

Effective filtration is critical for adequate public pool water quality. As stated in Queensland Health's Guidelines, "Effective filtration is essential pre-treatment to effective chlorination". None of the pool water treatment plants have filters designed in accordance with a standard e g DIN19643, including the 4 new filters installed in the 50 metre pool water treatment plant earlier this year. As a result, they will all become blocked with use, rendering them ineffective.

2.1.2 Filter Backwashes

Without the “Operation & Maintenance Manual” for each of the pool water treatment plants, JHC has been unable to review and comment on whether the filter backwash procedures, detailed in each manual, remove contaminants trapped in the filter’s bed or just wash contaminants off the surface of the filter’s media.

As detailed elsewhere in the Report, new flow meters recently installed in all the pool water treatment plants are not suitable for their intended use and, in addition, have often been inadequately positioned to allow measurement of the backwash flow to each filter, further compromising filter effectiveness.

2.1.3 Filter Media

JHC has been advised that AFM glass media has recently been installed in all filters. AFM glass media has remarkably similar gradings to traditional well-chosen sand and gravel filter media. However, it is considerably more expensive than traditional well-chosen sand and gravel filter media. JHC have requested details of the thicknesses and gradings of AFM media layers installed in each filter, in order to comment on their specification. To date, none have been provided.

2.2 Pool Water Treatment Plant - Flow Meters and Pressure Gauges

2.2.1 Installed Flow Meters

JHC’s 2014 Report recommended, as “required immediate maintenance” for all pool water treatment plants, installation of “flow meters and pressure gauges to allow monitoring of plant performance”. Pressure gauges have not been installed at the locations required to monitor plant performance. Flow meters have been installed in all the pool water treatment plants. During a site inspection on 24 March 2021, JHC reviewed the performance and position of the recently installed flow meters in each of the Facility’s five pool water treatment plants. Consideration was also given to improved positioning for replacement flow meters, given many of the flow meters were found to be inoperable. A copy of JHC’s 24 March 2021 Site Inspection Report has been attached in Appendix A.

The installed flow meters have considerable limitations, including the following:

- Paddle wheel flow meters have been installed. They are not suitable for measuring flow rates in public pool water treatment plants. The paddle wheel becomes fowled with particles suspended in the water eg hair, making their output unreliable. This has been confirmed by Council and JHC, during recent site inspections.
- Many of the flow meters have been poorly positioned. This has been confirmed during JHC’s site inspections. As a result, they cannot measure, as required, both the circulation flow rate and the backwash flow rate to each filter. One of the flow meters in the outdoor 25 metre pool water treatment plant cannot be accessed for a reading.

2.2.2 Testing of Alternative Flow Meters

An ultrasonic flow meter has been tested on each pool water treatment plant, in an effort to confirm that they would be capable of providing flow rates to the required accuracy. A copy of JHC's 15 April 2021 Report on those tests has been attached in Appendix B. The tests confirmed that ultrasonic flow meters would not be capable of providing flow rates to the required accuracy. The Report concluded that "consideration should be given to using full-bore magnetic flow meters". Subsequent discussions with Krohne, a European based manufacturer with offices in Australia, regarding full-bore magnetic flow meters, has confirmed that they manufacture a flow meter that would be suitable.

2.3 Pool Water Treatment Plant – Air Intake on Pump Suctions

JHC's 2014 Report recommended, as "required immediate maintenance" for the indoor 20 metre pool, outdoor rapid river and leisure pool, the repair of underground pipework "to eliminate air intake into pump suction". JHC's site inspections have identified that air intake continues to significantly compromise the performance of all three pool water treatment plants.

3.0 25 METRE POOL'S DELAMINATING PAINT

During one of JHC's site inspections, Council advised that the Outdoor 25 metre pool had been recently repainted and paint was now coming off, as pool users walked on the pool floor, compromising pool water quality. This pool should be shut immediately, to allow the problem to be addressed and made good.

4.0 JHC's 2014 REPORT – REQUIRED UPGRADES

JHC's 2014 Report recommended that before replacing any of the Facility's pools, a Master Plan be prepared for the site's proposed redevelopment. To date, a Master Plan has not been prepared.

4.1 Upgrades required within 3 years (2017)

JHC's 2014 Report recommended that, on completion of the Master Plan, the Indoor 20 metre pool and Outdoor 50 metre pool be replaced as soon as possible, given their relatively poor condition.

4.2 Upgrades required within 3 to 7 years (2017 - 2021)

JHC's 2014 Report recommended the Outdoor 25 metre pool be replaced next.

4.3 Upgrades required within 7 to 10 years (2021 - 2024)

JHC's 2014 Report recommended the Facility's final upgrade include replacement of the entry and amenity buildings, along with an upgrade of the carpark and provision of new leisure water attractions to replace the existing Spa, Rapid River and Leisure Pool.

5.0 RECOMMENDATIONS FOR THE NEXT 10 YEARS

In view of the above detailed health risks associated with the Facility's substandard pool water treatment plants, together with other pool water quality health risks detailed in JHC's 2014 Report, all of the pools and their water treatment plants should be replaced as soon as possible. With regard to pool water quality, the most significant pool and pool water treatment plant defects identified included the following:

a) Inadequate circulation of water in the pools and between the pools and their pool water treatment plants. Those defects can only be rectified by replacing the pools.
b) Ineffective filtration of pool water ie the filters become progressively blocked with use. This defect can only be rectified by replacing the existing filters with filters designed, manufactured and operated in accordance with standard DIN19643. Only the 50 metre pool water treatment plant could accommodate new filters, without also having to replace the pool water treatment plant. It is unfortunate that the four new filters, recently installed in the 50 metre pool water treatment plant, were not designed and manufactured to a standard that would ensure they did not become progressively blocked with use. Installation of an in-line turbidity meter will allow monitoring of the filter's effectiveness and should be undertaken immediately.
c) Inadequate sizing of pumps and pipework in the plant rooms together with substandard positioning of plant room equipment and pipework. These defects can only be rectified by replacement of the pool water treatment plants. The one exception is the 50 metre pool water treatment plant which has an adequately sized pump and pipework, together with reasonably well positioned equipment and pipework.

5.1 Operation of Pool Water Treatment Plants

As detailed in this Report, design and construction of the Facility's pool water treatment plants have been substandard, creating pool water quality health risks for pool users. Those health risks would be reduced a little, if the pool water treatment plants were operated at their optimum, in accordance with well written Operation & Maintenance Manuals.

- The Operation & Maintenance Manual for each of the five pool water treatment plants should be reviewed, to confirm that procedures detailed in each Manual are up to date, accurate and understood by the pool water treatment plant Operator. The Manuals will also require updating, following the replacement of equipment including flow meters, automatic chemical controllers etc.

- Daily turbidity testing of all five pools, in accordance with Queensland Health's Guidelines, should be added to current pool water testing.

5.2 Maintenance of Existing Pool Water Treatment Plants

JHC's recommendations for work required to, where possible, make good substandard work carried out in the pool water treatment plants since JHC's 2014 Report follow:

5.2.1 Replacement of Automatic Pool Water Chemical Controllers

Pool water Oxidation Reduction Potential (ORP) has been used to automatically control the dosing of sodium hypochlorite (ie liquid chlorine) in all five pool water treatment plants. ORP should never be used to control the dosing of chlorine in a public pool.

The ORP of pool water, in accordance with DIN19643, should however always be clearly displayed in a plant room. It tells the pool water treatment plant Operator, at a glance, whether chlorine is being used effectively as a disinfectant, at the current level of free chlorine and pool water pH. The automatic chemical controllers in all five pool water treatment plants require immediate replacement.

5.2.2 Replacement of Flow Meters

As detailed in this Report, the recently installed flow meters in all five pool water treatment plants require immediate replacement.

5.2.3 Installation of Turbidity Meter in 50 metre Pool Water Treatment Plant

The four new horizontal filters installed in the 50 metre pool water treatment plant have not been designed to an acceptable standard. As a result, they will become blocked with use. An in-line turbidity meter installed on pipework downstream from the filters is required to initially identify when the filters must be backwashed and ultimately to determine when the filters' media requires either cleaning or replacement.

During the next 10 years, in addition, equipment in the pool water treatment plants will obviously require maintenance due to fair wear and tear.

5.3 Repainting of the Outdoor 25 metre Pool

Paint on the pool floor is powdering as pool users walk up and down the pool for exercise, discolouring the pool's water and compromising pool water quality. The pool should be repainted, as soon as possible.

5.4 Site Master Plan

As recommended in JHC's 2014 Report, a Master Plan should be prepared for the site, with consideration given to the site being redeveloped in several stages.

5.5 Sequence for Replacing Pools

Once the Master Plan has been approved by Council, the pools should be replaced before the buildings, given the health risks associated with pool water quality. The sequence of pool replacement should be as follows:

Stage 1 Indoor 20 metre Pool. Of all the pools, as a learn to swim pool, water quality in this pool creates the biggest health risks for children under 6 years old and should therefore be the first pool to be replaced. It is also the pool that has the greatest income earning potential.

Stage 2 Outdoor 25 metre Pool. Consideration, during production of the Master Plan, should be given to replacement of the 20 metre and 25 metre pools at the same time, given their current proximity to the Facility's entry and change rooms, both of which are advantageous.

Stage 3 Rapid River and Leisure Pool with a Water Play Park.

Stage 4 50 metre pool

6.0 PRELIMINARY COST ESTIMATES AND TIMING FOR RECOMMENDATIONS

Preliminary cost estimates have been calculated based on current costs of delivery ie June 2021.

Activities requiring Immediate Action

1. Daily testing of turbidity in each pool.
2. Review and Updating of Operating & Maintenance Manuals for Pool Water Treatment Plants.
3. Replacement of substandard equipment in Pool Water Treatment Plants.
4. Installation of inline turbidity meters on inlet and outlet pipework to 50 metre Pool Filters.
5. Repaint Outdoor 25 metre Pool
6. Site Master Plan

Activities requiring Action as soon as possible

1. Replace Indoor 20 metre Pool
2. Replace Outdoor 25 metre Pool
3. Replace Rapid River and Leisure Pool with Water Play Park
4. Replace Outdoor 50 metre Pool
5. Replace Entry/Amenity Buildings

Operational Cost Estimates attached in Appendix C

Capital Cost Estimates attached in Appendix D

APPENDIX A

SITE INSPECTION CLEVELAND AQUATICS CENTRE (24/3/21)
(Allan Cockerell with Peter Honeysett - Redland City Council)

INSPECTION OF POOL WATER TREATMENT PLANT PIPE WORK TO IDENTIFY SUITABLE LOCATIONS FOR ULTRASONIC FLOW METERS TO REPLACE EXISTING PADDLE WHEEL FLOW METERS

Plant pipework for the 50 metre pool

The existing paddle wheel flow meter has been installed on a tapping band to the 300mm diameter PVC pipe that connects the circulation pump to the four new sand filters. The tapping band for the flow meter has been positioned 1.4 metres downstream from a 90 degree pipe bend and 2.1 metres upstream from a T fitting which supplies backwash water to the filters. SiteLab, who manufacture the SL1168 Ultrasonic flow meter proposed as a replacement flow meter, recommend 10 times the pipe diameter (ie 3.0 metres) be provided between the meter and 90 degree bends, both upstream and downstream. They also recommend clearance of 10 times the pipe diameter (ie 3.0 metres) for T fittings downstream from the meter. SiteLab have advised that the SL1168 meter reading accuracy when installed with only approximately half the recommended clearance to pipe fittings, would best be confirmed with a free onsite test.

It should also be noted as follows:

- The 300 mm diameter PVC pipe connecting the circulation pump to the four new sand filters reduces to 200 mm just before a 200 mm T branch. This may prevent the backwash flow rate through the filters from reaching the velocity required to fluidise the AFM filter media and thereby allow the release, to waste, of material trapped in the media. Confirmation would require the installation of a reliably accurate flow meter.
- At several locations there has been welding of the pipework's PVC solvent welded joints. This appears to have been required to seal leaks associated with faulty installation of pipework joints.
- PVC pipe take-offs for pool water heating should be separated by a butterfly valve which, when partially closed, promotes flow to the heater.
- Automatic air relief valves have been supplied but not installed to the top of all four new sand filters. Each valve will require the attachment of pipework, to discharge water safely.
- The bund for the 50 metre pool's sodium hypochlorite tank does not meet current work place health and safety requirements.

Plant pipework for the rapid river and leisure pools

On the leisure pool water treatment plant, the 150mm diameter PVC pipe with 2.1 metres between fittings, running across the width of the plant room, appears to be the best location for installation of a SiteLab SL1168 ultrasonic flow meter. Refer attached photo IMG0679. However the available pipe length of approximately 2.1 metres is slightly less than the 2.25 metre length recommended by SiteLab. SiteLab have advised that under these circumstances, meter reading accuracy would best be confirmed with a free onsite test.

On the rapid river pool water treatment plant, the 100 mm diameter PVC pipe with 2.3 m between fittings that runs along the length of the plant room, appears adequate for installation of a SiteLab SL1168 ultrasonic flow meter.

It should also be noted as follows:

- The existing paddle wheel flow meter has been installed on the leisure pool water treatment plant's filter discharge manifold, just before the last of three filters. As a result, during filter mode, it will only display the flow rate through the first two filters and not include the additional flow rate through the third filter. During backwash mode, it will only be able to display the backwash flow rate for the third filter and not the backwash flow rate for each of the first two filters.
- The existing paddle wheel flow meter has been installed on the rapid river pool water treatment plant's filter discharge manifold, just after the first of three filters. As a result, during filter mode, it will only display the flow rate through the last two filters and not include the additional flow rate through the first filter. During backwash mode, it will only be able to display the backwash flow rates for the last two filters and not the backwash flow rate for the first filter.
- The bund for the rapid river and leisure pools' sodium hypochlorite tank does not meet current work place health and safety requirements.

Plant pipework for the 25 metre and 20 metre pools

On the 25 metre pool water treatment plant, the vertical 100 mm diameter PVC pipe, on the circulation pump discharge, currently has a length of approximately 0.8 metres between the pump and a T fitting. That pipe length could be increased to approximately 1.6 metres and thereby provide the recommended minimum 15 diameter (ie 1.5 metre) length for installation of a SiteLab SL1168 flow meter.

It should also be noted as follows:

- In our Report "Cleveland Aquatic Centre Updated Pool Condition Assessment and Maintenance Plans (July 2014)" we advised with regard to backwashing the 25 metre pool's filters as follows:

  "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."

At a backwash flow rate of 8 LPS (ie 28.8 cubic metres/hr) the backwash velocity on a 1200mm diameter filter would be 25.4 metres/hr which is significantly less than the back wash flow rate the manufacturer of AFM media, Dryden Aqua recommends for the filters' existing Grade 1 AFM glass media. Our 2014 Report strongly recommended immediate replacement of the filters and upgrading of the filter pipework and valves.

- The bund for the 25 metre and 20 metre pools' sodium hypochlorite tank does not meet current work place health and safety requirements.

On the 20 metre pool water treatment plant. the existing 100mm diameter pipe, connected to the circulation pump;s discharge, appears to have sufficient horizontal length between pipe fittings to accommodate the installation of a SiteLab SL1168 flow meter.

It should also be noted as follows:

- In our Report "Cleveland Aquatic Centre Updated Pool Condition Assessment and Maintenance Plans (July 2014)" we advised with regard to the 20 metre pool's filter backwash flow rate as follows:

  "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 back wash flow will not be achieved."

  Our 2014 Report strongly recommended installation of an above ground tank to provide water for filter backwash.

APPENDIX B

ULTRASONIC FLOW METER TEST - CLEVELAND AQUATIC CENTRE (15/4/21)
(Allan Cockerell with Peter Honeysett - Redland City Council)

INTRODUCTION

Renoy Paul from Proconit tested SiteLab's SL1168 ultrasonic flow meter with a view to their use in the site's five pool water treatment plants, as replacements for recently installed paddle-wheel flow meters that have proved to be very unreliable. The estimated cost for supply and installation of 5 ultrasonic flow meters is $20,000. Ultrasonic flow meters have been widely used in public pool water treatment plants. However, if they were used in the five pool water treatment plants at the Cleveland Aquatic Centre, they would not have the flow meter manufacturer's recommended upstream and downstream clearances to pipe fittings. The tests were intended to determine whether the reduced minimum clearances would significantly impact the accuracy of flow meter readings.

There are several ways of measuring the flow of water in a pipe under pressure, including the following:

- Paddle wheel flow meters
  Paddle wheel flow meters have been widely used in pool water treatment plants. They are cheap but unreliable, as they are prone to blockage. As a result, they are seldom used to measure flow in a pool water treatment plants, now that there are more reliable alternatives.
- Magnetic flow meters
  Magnetic flow meters, particularly full-bore magnetic flowmeters, are very reliable. Unfortunately, full-bore magnetic flowmeters increase in price with increasing pipe diameter.
- Ultrasonic flow meters
  The price of ultrasonic flow meters do not increase with increasing pipe diameter. However, they do require more maintenance than full-bore magnetic flow meters. Approximately every 12 months, the gel used to ensure adequate connection between the flow meter attachment and the pipe requires replacement, in order to ensure reliable output. The reliability of both magnetic and ultrasonic flow meters is dependent on the distances between the meter and pipe fittings upstream and downstream. Ultrasonic flow meters require larger clearances than magnetic flow meters for some pipe fittings and their accuracy appears to be more susceptible to pipe vibrations and the presence of air in the water, as seen in the test results detailed in this Report.

TESTING

A SiteLab SL1168 ultrasonic flow meter was trialled on the following pool water treatment plants:

1) **50 metre pool water treatment plant**

   At the time of the trial, the installed paddle-wheel flow meter was not working.

   The trial confirmed the following:

   - The flow rate reading of 296 cm/hour, during pool water filtration, appeared to be relatively unaffected by pipe fittings upstream and downstream from the meter being closer than recommended by the flow meter manufacturer. The flow meter display indicated a 98% reliability for the flow reading.
   - Although the flow meter also displayed a reliability of 98% for a flow rate of 268 cm/hour during filter backwashing, the reading appeared to be significantly affected by the T pipe fitting, located less than the recommended minimum distance of 10 pipe diameters downstream from the flow meter. The backwash flow rate should have been higher than the filtration flow rate.
   - Had pressure gauges been fitted on the circulation pump's inlet and outlet pipes, they could have been used to estimate pump flow rates during both filtration and filter backwashing and thereby provided a check on the flow rate readings.

   Conclusion:

   Consideration should be given to using a full-bore magnetic flow meter which should be more reliable than an ultrasonic flowmeter, in this situation.

2) **Leisure pool and rapid river pool water treatment plants**

a) Leisure pool water treatment plant

   At the time of the trial, the installed paddle-wheel flow meter was not working.

   The ultrasonic flow meter was unable to provide a flow reading when connected to the 150 mm diameter pipe downstream from the leisure pool circulation pump. Pipe vibration and circulation pump cavitation were thought to be the cause.

b) Rapid river pool water treatment plant

   At the time of the trial, the paddle-wheel flow meter, installed on the rapid river pool water treatment plant, was reading 1,450 litres/minute (87 cm/hour), during filtration. With the paddle-wheel flow meter installed on the filters' outlet pipe manifold, downstream from the first of 3 filters, the flow reading would not have included the flow rate through the first filter. Taking this into account and using the flow meter reading of 1450 litres/minute, the flow rate through all 3 filters would be approximately

2,175 litres/minute (130 cm/hour). At that flow rate, the velocity of flow through a 100 mm diameter PVC pipe would be approximately 4 metres/second which is very high for flow through a 100 mm diameter PVC pipe, casting doubt over the accuracy of the paddle-wheel flow meter reading.

The ultrasonic flowmeter was able to provide flow readings when connected to the 100 mm diameter pipe, downstream from the rapid river circulation pump. Unfortunately, the flow readings were found to be unreliable. Flow readings ranged between 15.3 cm/hour and 37.1 cm/hour, each with a displayed reliability of 96 or 97%, casting doubt as to the reliability of the displayed accuracy percentage. Pipe vibration and circulation pump cavitation were thought to have caused the variability in flow readings.

Conclusion

Consideration should be given to using a full-bore magnetic flow meter on both the rapid river and leisure pool water treatment plants. The full-bore magnetic flow meter should be more reliable than an ultrasonic flowmeter, in these situations.

3) Outdoor 25 metre pool and indoor 20 metre pool water treatment plants

a) Outdoor 25 metre pool water treatment plant

The paddle wheel flow meter, installed on the 25 metre pool water treatment plant, was inaccessible for a reading. The flow meter was installed on the return to pool pipe. As a result, the meter would be unable to provide flow readings during filter backwashing.

The ultrasonic flow meter was connected to a 100 mm diameter vertical PVC pipe connected to the 25 metre pool's circulation pump discharge. The downstream distance between the flow meter and the circulation pump was less than the flow meter manufacturer's minimum distance recommendation as was the upstream distance to a T fitting in the pipe work. As a result, the ultrasonic flow meter was unable to provide a reading.

b) Indoor 20 metre pool water treatment plant

The paddle wheel flow meter, installed on the 20 metre pool water treatment plant, had a reading of 468 litres/minute (28 cm/hour), at the time of the trial. This flow rate has reasonably good agreement with the 20 metre pool's estimated circulation flow rate of between 360 and 540 litres/minute as detailed in JHC's 2014 Cleveland Aquatic Centre Report.

The Ultrasonic flow meter was installed on a 100 mm diameter horizontal pipe, downstream from the 20 metre pool's circulation pump discharge. The ultrasonic flowmeter was unable to provide a reliable reading, despite the flowmeter having adequate distances both upstream and downstream from pipe fittings. It was thought that air in the water was creating a problem. A doppler flow meter was installed and used to confirm the presence of air in the water.

Conclusion

Consideration should be given to using a full-bore magnetic flow meter on both the outdoor 25 metre and indoor 20 metre pool water treatment plants. The full-bore magnetic flow meter should be more reliable than an ultrasonic flowmeter, in these situations.

APPENDIX C

Operational Cost Estimates

Operational	50m Pool	25m Pool	Indoor pool	Play pool/RR
Year 1	• Review & update operations & maintenance manual, including cyclical preventative maintenance programs $5,000 • Daily water quality testing and reporting, including pool water turbidity • Condition assess treatment plant equipment including pump renewal • Analysis of electric/gas/hybrid heating systems	• Review & update operations & maintenance manual, including cyclical preventative maintenance programs $5,000 • Daily water quality testing and reporting, including pool water turbidity • Condition assess treatment plant equipment including pump renewal • Renew floor surface to eliminate wear and impact on water quality - $60,000	• Review & update operations & maintenance manual, including cyclical preventative maintenance programs $5,000 • Daily water quality testing and reporting, including pool water turbidity • Condition assess treatment plant equipment including pump renewal	• Review & update operations & maintenance manual, including cyclical preventative maintenance programs $9,000 • Daily water quality testing and reporting, including pool water turbidity • Condition assess treatment plant equipment including pump renewal
Year 2	Water quality - online monitoring and reporting to RCC systems	Water quality - online monitoring and reporting to RCC systems	Water quality - online monitoring and reporting to RCC systems	Water quality - online monitoring and reporting to RCC systems
Year 3				
Year 4				
Year 5	• Tile repairs - $100,000 • Pant concourse - $35,000			

All price estimates exclude GST

APPENDIX D

Capital Cost Estimates

Capital	50m Pool	25m Pool	Indoor pool	Play pool/RR
Year 1	• Flow meter $18,000 • Inline turbidity meter $11,000 • Replace automatic chemical controllers $22,000	• Flow meter $7,000 • Replace automatic chemical controllers $22,000	• Flow meter $7,000 • Replace automatic chemical controllers $22,000	• Flow meter $15,000 • Replace automatic chemical controllers $40,000 • Shade structure over RR - $30,000
	Facility master plan $75,000			
Year 2	• Replace pool heating system?			
Year 3				
Year 4				
Pool Renewal				
Priority 1			Replace indoor pool $4,500,000	
Priority 2		Replace 25m pool $3,500,000		
Priority 3				Replace play pool/RR
Priority 4	Replace 50m pool $6,000,000			

All price estimates exclude GST

APPENDIX E

J.H. COCKERELL PTY LTD
Specialist Pool Engineers

J.H. COCKERELL PTY. LTD.
CONSULTING ENGINEERS
ACN 010 075 564
ABN 72 226 534 268

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

PREPARED BY

J.H. Cockerell Pty Ltd
Consulting Structural & Hydraulic Engineers
Level 2 / 170 Alfred Street
Fortitude Valley
Brisbane Qld 4006
Ph: (07) 3852.1041
Fax: (07) 3252.4201

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This Cleveland Aquatic Centre Updated Pool Condition Assessment and Maintenance Plan:

- *Has been prepared by JH Cockerell Pty Ltd (JHC) for the Redland City Council;*
- *May only be used and relied on by Redland City Council;*
- *Must not be copied, used by, or relied on by any person other than Redland City Council without the prior written consent of JHC;*

JHC and its employees expressly disclaim responsibility to any person other than Redland City Council arising from or in connection with this Report.

The services undertaken by JHC in connection with preparing this report are as follows:

- *The buildings, pools, associated plant and equipment, structures, pavements and other external elements were visually assessed to establish their condition and position in their lifecycles;*
- *The opinions, conclusions and any recommendations in this Report are based on assumptions made by JHC when undertaking services and preparing the Report.*
- *JHC expressly disclaims responsibility for any error in, or omission from, this report arising from or in connection with any of the assumptions being incorrect;*
- *Subject to the paragraphs in this section of the Report, the opinions, conclusions and any recommendations in this Report are based on conditions encountered and information reviewed at the time of preparation.*
- *Non-conformances associated with statutory building regulations (BCA), Disabled Access Provisions (DDA), Work Place Health and Safety (WH&S) requirements have not been identified and assessed;*
- *Where the extent of work is not known or where technical difficulties may be evident, fees may be indicated for detailed investigation and identification of the problem for use in subsequent budget periods;*

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Document control

Issue	Description	Date
P1	Preliminary Issue for Review	03/07/2014

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 2 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.

aquatic one

Aquatic Facility Audit

AQ1-Q224-DR1, Revision A

Cleveland Aquatic Centre

REDLAND CITY COUNCIL

19/14 Ashtan Place, Banyo Queensland 4014
PO Box 135 Northgate Queensland 4013
ABN 66 633 627 433 **t** 07 3267 7295

PROJECT DETAILS

Project:	**Cleveland Aquatic Centre**
Area:	All pools
Client:	Redland City Council
Reference:	AQ1-0224-DR1, Revision A

REVISION SCHEDULE

Revision	Date	Description	By
A	09/05/22	Issued for client review	LHB

19/14 Ashtan Place, Banyo Queensland 4014
PO Box 135 Northgate Queensland 4013
ABN 66 633 627 433 **t** 07 3267 7295
www.aquatic.one

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19/14 Ashtan Place, Banyo Queensland 4014
PO Box 135 Northgate Queensland 4013
ABN 66 633 627 433 **t** 07 3267 7295
www.aquatic.one

19/14 Ashtan Place, Banyo Queensland 4014
PO Box 135 Northgate Queensland 4013
ABN 66 633 627 433 **t** 07 3267 7295

INTRODUCTION

Figure 1: Leisure Pools at the Cleveland Aquatic Centre

Aquatic One was commissioned by Redlands City Council to undertake a site audit of the existing aquatic elements at the Cleveland Aquatic Centre in Brisbane, Queensland. This report details the findings of the audit of the centre and provides a condition report on the swimming pools and filtration plant currently installed.

A representative from Aquatic One attended site in March 2022 and inspected the pools as well as the filtration and sanitation plant installed for the aquatic elements at site. Focus was given to equipment condition, filtration and sanitation, operation and suitability for use.

This report and associated documents are based on site visit observations and interviews with staff. Whilst all investigation and reporting works have been undertaken by experienced aquatic personnel and qualitative assessments and predictions have been made based on relevant experience, it is not possible to quantify opinionative elements such as general condition or predict with complete accuracy elements such as expected lifespan. These factors should be taken into consideration whilst reading this report.

This report references a number of standards and codes as required by the site observations. References to 'NCC' refer to the National Construction Code. Australian Standards are referred to by their standards number and year of publication, eg. AS 3780-2008.

www.aquatic.one
19/14 Ashtan Place, Banyo Queensland 4014
PO Box 135 Northgate Queensland 4013
ABN 66 633 627 433 t 07 3267 7295

APPROXIMATE COST FIGURES

Any approximate cost figures provided within this report are rough approximations only, intended to provide a concept as to the magnitude of the cost expected for works described. They are not intended to be used for accurate budgeting, funding or works quoting.

19/14 Ashtan Place, Banyo Queensland 4014
PO Box 135 Northgate Queensland 4013
ABN 66 633 627 433 **t** 07 3267 7295

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SITE DESCRIPTION

GENERAL OVERVIEW

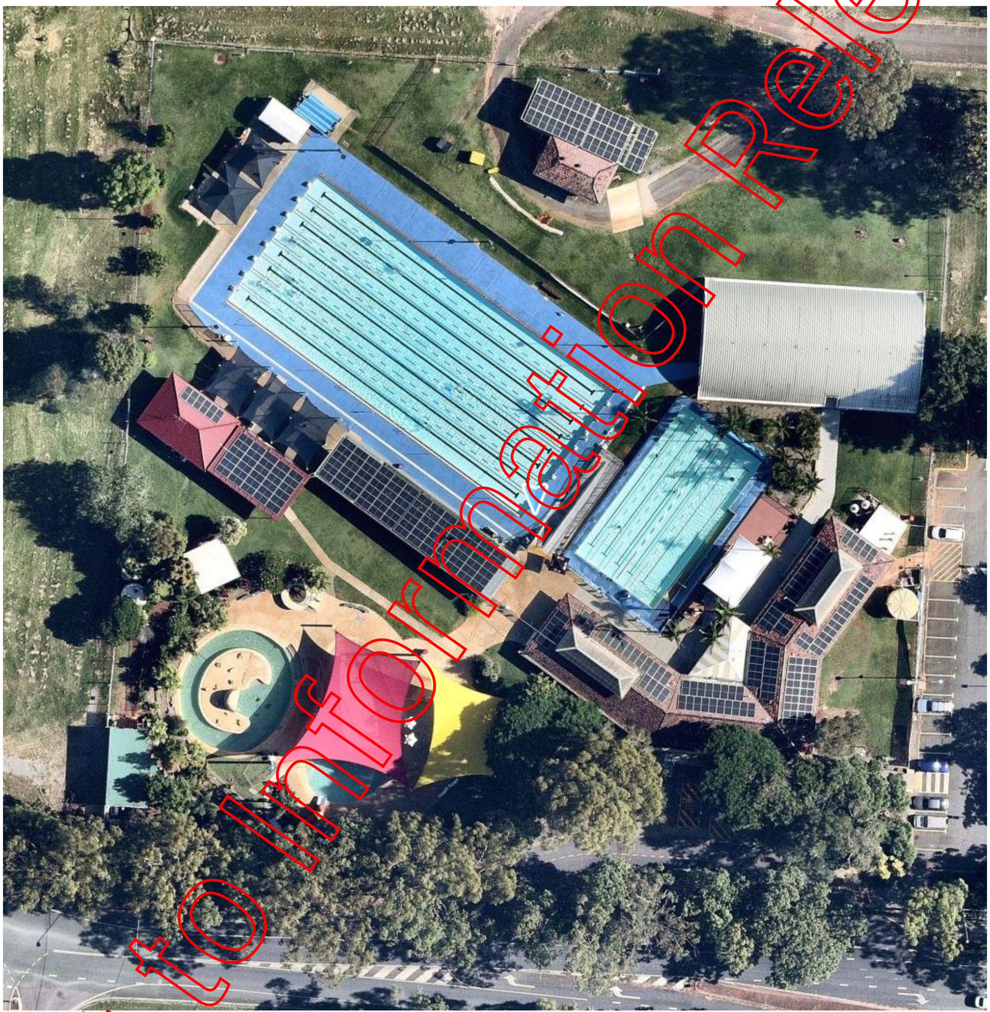

Figure 2: Aerial photo of facility

The Cleveland Aquatic Centre is a publically-accessible swimming pool hosting a mixture of aquatic facilities including:

- Outdoor 25m Lap Pool
- Outdoor 50m Lap Pool
- Indoor LTS Pool
- Outdoor Play Pool with Waterslide
- Outdoor River Pool

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The facility is understood to have originally opened in the early 1970's, with the 25m pool being added in the mid-90's. The dates for the play pool and river pool are not known but are suspected to be constructed around a similar time. Relatively little as-constructed documentation of the elements in the facility was available for viewing at the time of the inspection, primarily covering the 50m pool only.

Each aquatic element at site is serviced by a standalone filtration system, located across three equipment rooms:

- The 50m pool equipment is located in a dedicated equipment room to the north of the site.
- The 25m and LTS pool equipment is located in a combined equipment room to the east of site.
- The Play and River pool equipment is located in a combined equipment room to the west of site.

All systems are serviced by sand filtration systems, liquid chlorine and either acid or CO_2 dosing. The pools are heated through either electric heat pumps or gas heating systems.

At the time of the inspection, the filtration systems were operational and the pools full of water. The facility was open to the public.

SWIMMING POOL DESCRIPTION

OUTDOOR 50M POOL

The outdoor 50m pool is an 8 lane 50m fully tiled reinforced concrete lap pool. The pool is 20.5m wide, 1m deep at each end and grades to 2m deep in the centre. Wet decks are placed to the two long sides of the pool and raised hobs to the two ends. The pool is understood to be from the original construction of the site in the 1970's.

OUTDOOR 25M POOL

The pool is a 25m long 6 lane lap pool, understood to be of concrete construction with a fiberglass internal lining. The pool is 1m deep at the shallow end, grading down to 1.2m at the deep end. An access ramp provides access to one side of the pool. The pool is a skimmer design pool. The pool is understood to have been constructed in the 1990's, replacing an existing wading pool.

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INDOOR LTS POOL

The pool is a 20m long x 6.8m wide (6m main body with 800mm wide bench) reinforced concrete pool fitted with a fiberglass internal liner. The pool is 1m deep to the full extent with a 250mm deep bench along one side. The pool is a skimmer design pool, understood to be from the original construction in the 1970's.

OUTDOOR PLAY POOL

The pool is a freeform play pool, approximately 25m long x 20m wide overall. The pool is varying depth throughout and is fitted with a waterslide and various water toys. The pool is a skimmer design pool, understood to be constructed in the early 2000's.

OUTDOOR RIVER POOL

The pool is an ellipse-shaped river pool, approximately 17m long and 15m wide. The pool is of reinforced construction and is a constant depth to the perimeter of the ~2.4m wide channel. The main feature for the pool is the channel flow system, where large pumps draw water from the side of the pool and inject into floor jets to circulate water around the channel. The pool is a semi-skimmer design pool, understood to be constructed in the early 2000's.

POOL WATER CIRCULATION

OUTDOOR 50M POOL

In this pool, water circulation is provided through the following means:

1. Filtered water is delivered into the pool through a center return channel running along the length of the pool, fitted with small outlet grates in the top surface.
2. Soiled water overflows wet deck gutters to the two long sides of the pool. It collects in underground pipework and flows to the drawoff tank adjacent the north-eastern corner of the pool.
3. Balance lines appear to connect the pool to the balance tank through the wall to prevent the tank running dry.

OUTDOOR 25M POOL

In this pool, water circulation is provided through the following means:

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1. Filtered water is delivered into the pool through a series of wall return fittings along both sides of the pool. The returns are currently open pipes and not provided with fittings.
2. Soiled water is drawn into 10 skimmer boxes located along the two long sides of the pool. Pipework joins these skimmer boxes back to the equipment room.

INDOOR LTS POOL

In this pool, water circulation is provided through the following means:

1. Filtered water is delivered into the pool through six wall return fittings generally installed along the bench but with one fitting installed in the corner of the pool.
2. Soiled water is drawn into three skimmer boxes located along the long side of the pool opposite the bench. Pipework joins these skimmer boxes back to the equipment room.

OURDOOR PLAY POOL

In this pool, water circulation is provided through the following means:

1. Filtered water is delivered into the pool through three rows of floor returns installed across the pool.
2. Soiled water is drawn into a series of skimmer boxes placed around the walls of the pool. Pipework joins these skimmer boxes back to the equipment room.
3. Wall suctions are present in the pool. Whilst as-constructed documentation is not available and the pipework pathways could not be confirmed, it's assumed that some of these wall suctions connect to the skimmers as relief lines whilst others connect to the feature suction pump.

OUTDOOR RIVER POOL

In this pool, water circulation is provided through the following means:

1. A large grated overflow sump is located in the wall of the pool adjacent the stairs. Water overflows into this sump. A large single suction fitting in this sump connects through pipework up to the plant room.
2. The pipe splits at the plant room into two suction lines which appear in the pump well. The two main river circulation pumps connect to these pipes then tee together into a single line above these pipes before flowing back out to the

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pool. The pipework splits at the pool into series of river flow jets located in the floor of the pool.

3. The filtration pumps draws water from the river pump outlets, and pumps through the filtration system in the plant room. The return water is then delivered back into the river pump outlet line downstream of a check valve. It appears as though previously this system was directly connected to the pool, as cut-off pipework is present nearby in the plant room.

FILTRATION PLANT

OUTDOOR 50M POOL

This pool is serviced by a pressure sand filtration plant. A single end-suction centrifugal circulation pump located in the equipment room draws soiled water from the drawoff tank through a hair and lint strainer and pumps the water through four fiberglass high-rate pressure sand filters. After passing through the filters, the water collects into a single underground pipe which flows back to the pool.

The filter is cleaned by backwashing; pumping water through the filter chamber beds in a reverse direction, with the waste water flowing to a sewer discharge pit in the equipment room.

Primary sanitation is provided through liquid sodium hypochlorite. A bulk storage tank is located in the equipment room. An automatic water chemistry controller measures the ORP level and pH level of the pool water and automatically controls a chlorine dosing pump. pH is regulated using CO_2, which is stored in a bulk tank outside the equipment room and injected into the filtration stream when the chemical controller measures the pH level as being too high.

Pool heating is provided through direct-fired gas pool heaters. Pool water is drawn from the filtration stream downstream of the filters and passed through a pair of commercial pool gas heaters before being returned to the filtration stream.

OUTDOOR 25M POOL

This pool is serviced by a pressure sand filtration plant. A single end-suction centrifugal circulation pump located in the equipment room draws soiled water from the skimmers through a hair and lint strainer and pumps the water through three fiberglass high-rate pressure sand filters. The skimmers are connected to the plant room through a pair of 80mm pipes, suspected to be one pipe to each side of

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the pool. After passing through the filters, the water collects into three 80mm underground pipes which flows back to the pool.

The filter is cleaned by backwashing; pumping water through the filter chamber beds in a reverse direction, with the wastewater flowing to a drain in the floor of the plant room.

Primary sanitation is provided through liquid sodium hypochlorite. A bulk storage tank is located in the equipment room. An automatic water chemistry controller measures the ORP level and pH level of the pool water and automatically controls a chlorine dosing pump. pH is regulated using CO2, which is stored in a bulk tank outside the equipment room and injected into the filtration stream when the chemical controller measures the pH level as being too high.

Pool heating is provided through a direct-fired gas pool heater. Pool water is drawn from the filtration stream downstream of the filters and passed through a single commercial pool gas heater before being returned to the filtration stream.

INDOOR LTS POOL

This pool is serviced by a pressure sand filtration plant. A single end-suction centrifugal circulation pump located in the equipment room draws soiled water from the skimmers through a hair and lint strainer and pumps the water through two fiberglass high-rate pressure sand filters. The skimmers are connected to the plant room through a single 150mm pipe. After passing through the filters, the water collects into a single DN100 underground pipe which flows back to the pool.

The filter is cleaned by backwashing; pumping water through the filter chamber beds in a reverse direction, with the wastewater flowing to a backwash holding tank outside the equipment room.

Primary sanitation is provided through liquid sodium hypochlorite. A bulk storage tank is located in the equipment room. An automatic water chemistry controller measures the ORP level and pH level of the pool water and automatically controls a chlorine dosing pump. pH is regulated using CO2, which is stored in a bulk tank outside the equipment room and injected into the filtration stream when the chemical controller measures the pH level as being too high. A UV secondary sanitizer is installed on the return to pool pipework to assist with bacterial control.

Pool heating is provided through a direct-fired gas pool heater. Pool water is drawn from the filtration stream downstream of the filters and passed through a single commercial pool gas heater before being returned to the filtration stream.

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OUTDOOR PLAY POOL

This pool is serviced by a pressure sand filtration plant. A single end-suction centrifugal circulation pump located in the equipment room draws soiled water from the skimmers through a hair and lint strainer and pumps the water through three fiberglass high-rate pressure sand filters. The skimmers are connected to the plant room through a single suction pipe of an unknown configuration. After passing through the filters, the water collects into a single underground return pipe feeding into the rows of filtered water returns.

The filter is cleaned by backwashing; pumping water through the filter chamber beds in a reverse direction, with the wastewater flowing to a backwash holding tank located outside the equipment room.

Primary sanitation is provided through liquid sodium hypochlorite. A bulk storage tank is located in the equipment room. An automatic water chemistry controller measures the ORP level and pH level of the pool water and automatically controls a chlorine dosing pump. pH is regulated using acid, which is stored in a small bulk tank in the corner of the equipment room and injected into the filtration stream when the chemical controller measures the pH level as being too high.

Pool heating is provided through a multiple electric heat pumps located in an enclosure outside the equipment room. Pool water is drawn from the filtration stream downstream of the filters and passed through the heat pumps before being returned to the filtration stream.

Feature pumping is provided by a circulation pump located in a cabinet outside the equipment room on the downhill side. The feature pump draws water from an unknown source and pumps the water through an actuated valve manifold. The actuated valves then connect to the various features.

OUTDOOR RIVER POOL

This pool is serviced by a pressure sand filtration plant. A single end-suction centrifugal circulation pump located in the equipment room draws soiled water from the outlet of the river circulation pumps through a hair and lint strainer and pumps the water through three fiberglass high-rate pressure sand filters. Two of the filters are the original filters whilst the third is a repurposed filter from a disused spa onsite. After passing through the filters, the water is returned into the river circulation stream.

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The filter is cleaned by backwashing; pumping water through the filter chamber beds in a reverse direction, with the wastewater flowing to a backwash holding tank located outside the equipment room.

Primary sanitation is provided through liquid sodium hypochlorite. A bulk storage tank is located in the equipment room. An automatic water chemistry controller measures the ORP level and pH level of the pool water and automatically controls a chlorine dosing pump. pH is regulated using acid, which is stored in a small bulk tank in the corner of the equipment room and injected into the filtration stream when the chemical controller measures the pH level as being too high.

Pool heating is provided through a multiple electric heat pumps located in an enclosure outside the equipment room. Pool water is drawn from the filtration stream downstream of the filters and passed through the heat pumps before being returned to the filtration stream.

Feature pumping is provided by a pair of large river circulation pumps located in the recessed pump well. The feature pumps draw water from the drawoff sump in the side of the pool and return it to a series of angled floor river boost jets.

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SITE OBSERVATIONS

This section details observations from the inspection.

AQUATIC FACILITIES

50M POOL GENERAL ITEMS

Figure 3: 50m Pool

Applicable To:

- 50m Pool

Observations

- The pool appears to be slightly out of level. More water was evident flowing over the northern wet deck compared to the southern. This may be a result of structural movement or may simply be poor construction tolerance at the time of the initial build. The level is not such that it causes immediate reason for concern however should be monitored.
- The balance tank lids are concrete infilled lids, which are heavy and present a risk for operational staff.

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- Tiling in the wet deck gutters is failing in places.
- The tiling in the floor of the pool is not slip-resistant. Activities in the pool that require friction to the floor (such as aqua-aerobics, LTS and the like) have an increased risk of injury if slip resistant finishes are not utilized.
- The gutter on the northern side appears almost flooded at one end. This is indicative that the flow capacity of the soiled water gravity system is at its peak, coupled with a bias of water over one side of the pool.
- The gutter design is outdated, presenting as an open channel to the full length with pool access over this channel. This presents a risk of ankle injury and falls/trips.
- The filtered water return system is a single row of returns along the centre of the pool. This is likely to be resulting in poor circulation and mixing of the pool water as this style of return has a very low impact beyond the return itself.

Recommendations

- Undertake a survey of the pool wall levels and repeat in 12 months to determine if there is any movement.
- Replace the tank lids with lighter lockable items such as Terra Firma lids.
- Rectify failed tiling. Undertake a detailed grout inspection on the pool and repair / replace as necessary.
- Consult with operational staff regarding floor tiling slip level and identification of any operational issues experienced.
- Consider providing grated covers to the open channel wet decks.
- Undertake circulation dye testing in accordance with the Model Aquatic Health Code. If dead spots are identified, improvements may be required to the filtered water return system.

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Additional Photographs

Figure 4: Failed tiling in gutter floor

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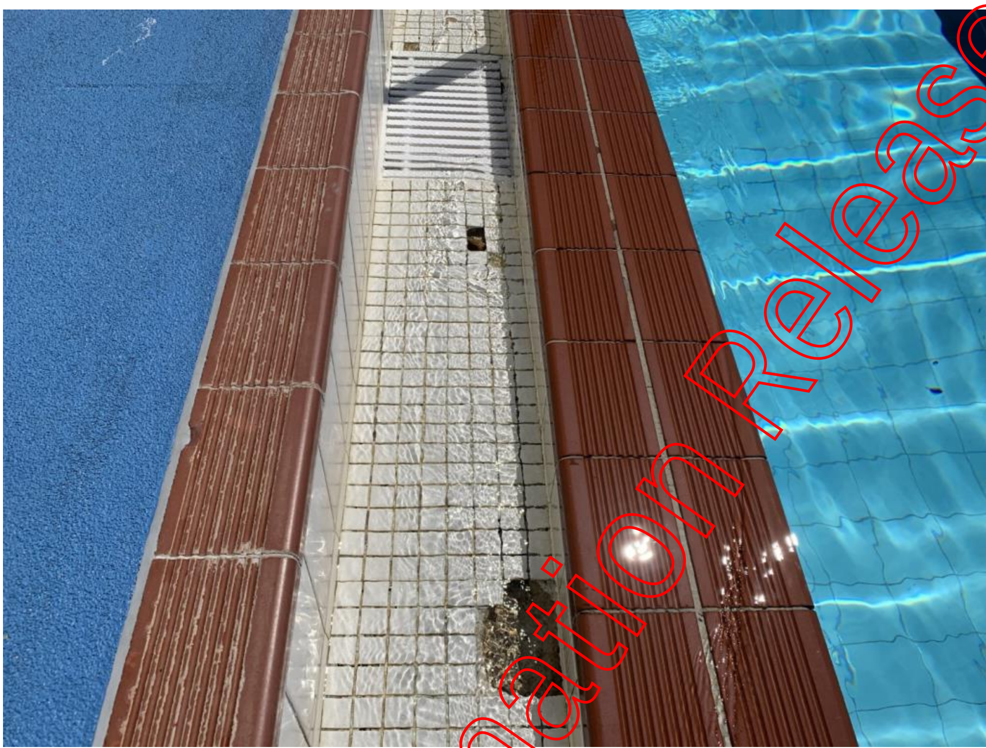

Figure 5: Damaged tiling in open gutter

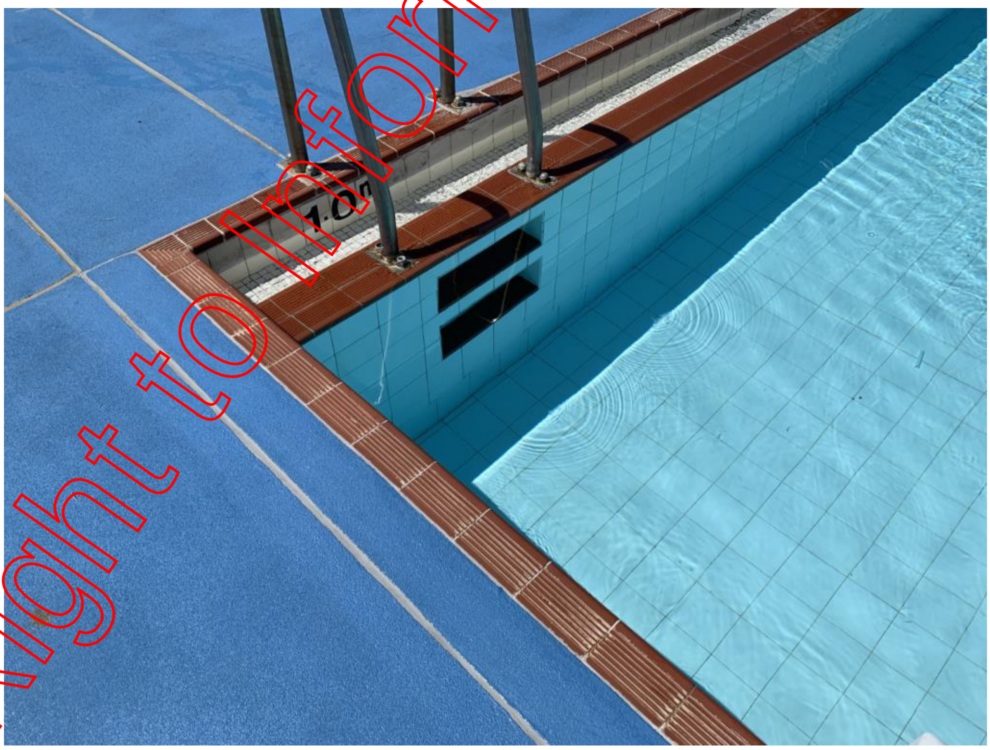

Figure 6: Steps into pool over gutter presenting injury risk

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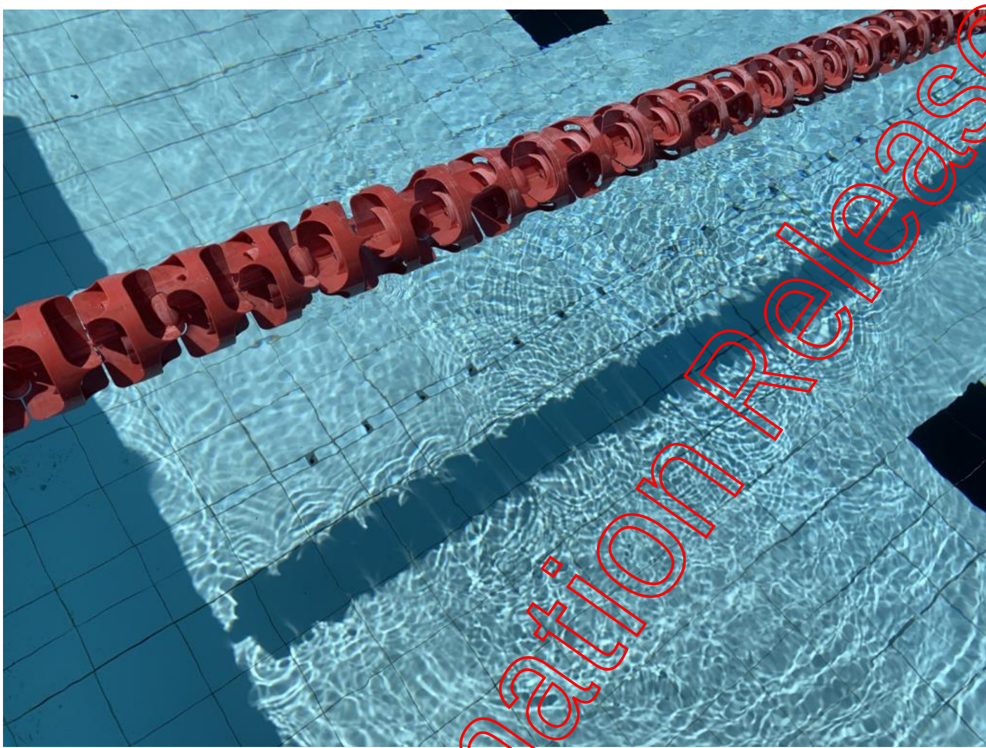

Figure 7: Filtered water returns to pool floor

Figure 8: Heavy balance tank lid

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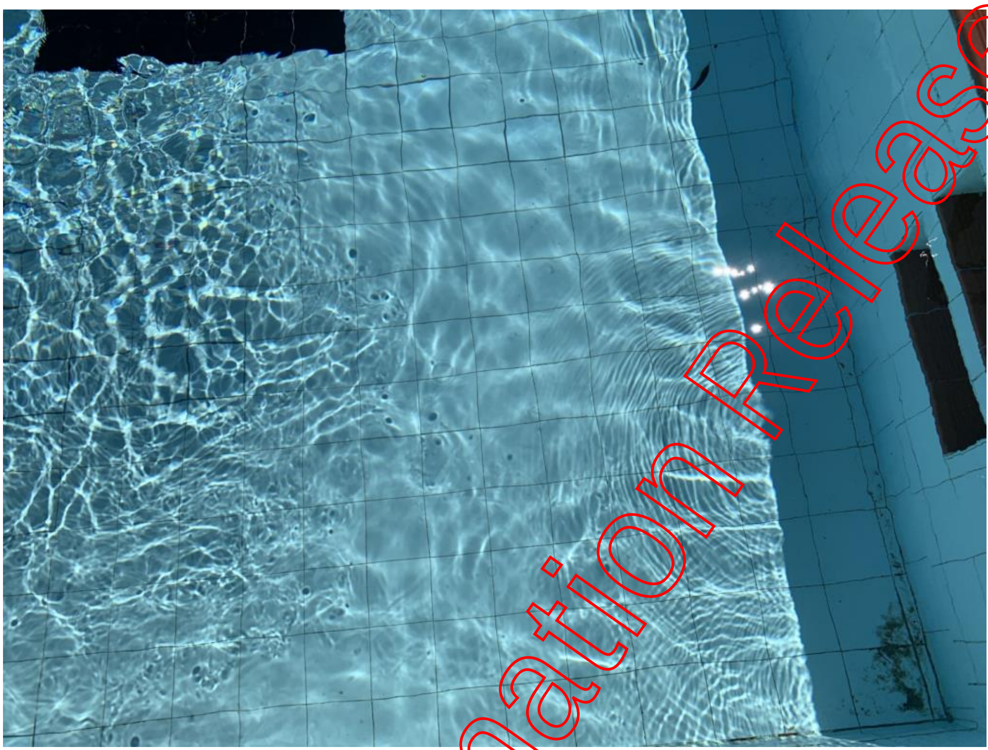

Figure 9: Non-slip resistant tiling on pool floor

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25M POOL GENERAL ITEMS

Figure 10: 25m Pool

Applicable To:

- 25m Pool

Observations

- At the time of the inspection, the pool was very cloudy. This is a reported problem by the operators, with indications that the painted internal finish is failing. This paint failure is observed in particular areas of the pool, where the finish has severely degraded and the underlying structure is visible, indicating poor installation techniques in these areas.
- Flow through the pool appears to be very low. Water ebbs into the skimmers whereas it would usually have a visible flow.
- None of the skimmers are fitted with strainer baskets, which can result in pipework blockages.
- None of the filtered water returns to the pool have a fitting such as an eyeball present. Instead, open pipes are present in the pool which could become a hand entrapment.

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- Access around the pool does not comply with Royal Lifesaving Guidelines for Safe Pool Operation (min 1000mm for low traffic areas, min 3000mm for high traffic areas).
- A crack was observed in the pool wall at the upper level. This crack appears minor, however the fiberglass liner makes observation of other structural issues difficult.

Recommendations

- The painted finish in the pool is at the end of life and requires replacement, noting that also the fiberglass liner below the pool may be problematic due to its age. A higher-level approach towards the pool finish is required as discussed in the *Conclusions* section.
- The low flow through the filtration system is impacted by several factors, including the pipework, plant and pool fittings. This is discussed further in the *25m Filtration Plant* section.
- Provide strainer baskets to the skimmers.
- Provide eyeball fittings to the outlets.
- Review access in and around the pool and apply a risk assessment to mitigate movement and access risks.
- If the liner is to be removed, undertake a detailed structural assessment of the underlying structure.

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Additional Photographs

Figure 11: Cloudy water, poor access across end of pool

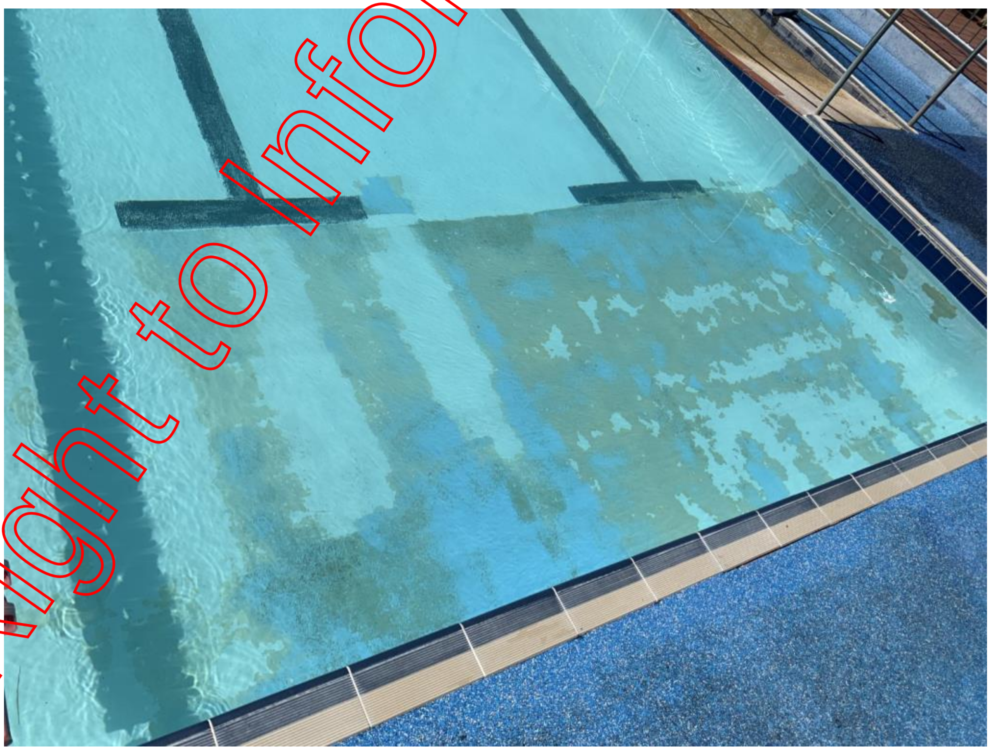

Figure 12: Region of failed finish in pool

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Figure 13: Skimmer without basket

Figure 14: Uncovered filtered water returns

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Figure 15: Crack in structure

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25M POOL ACCESS RAMP

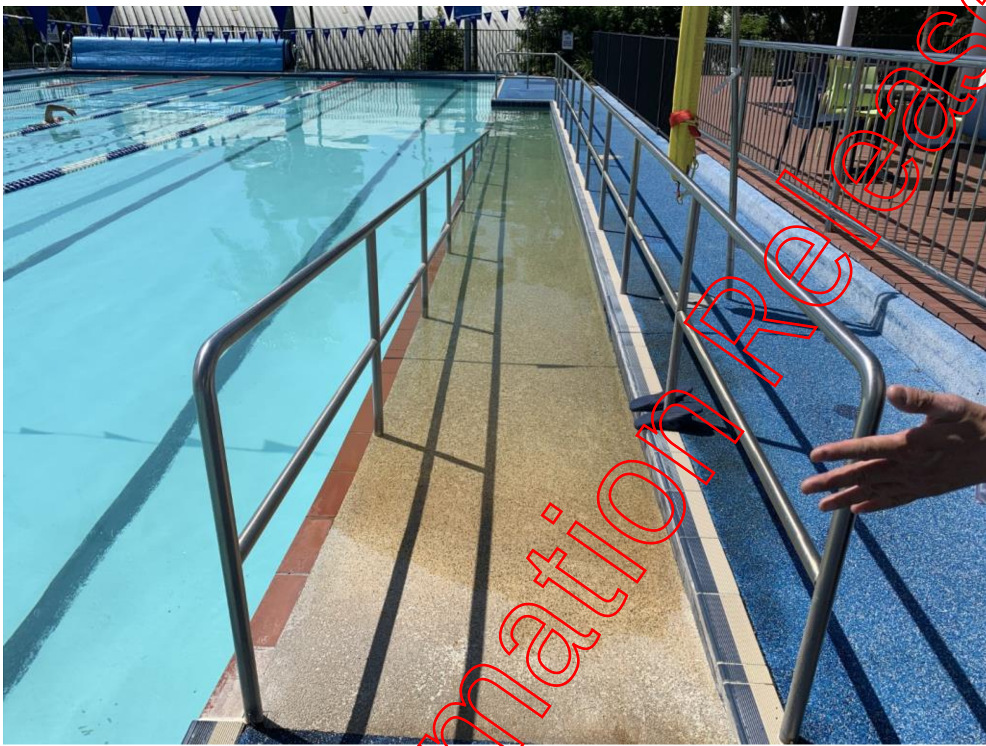

Figure 16: 25m Access Ramp

Applicable To:

- 25m Pool

Observations

- The 25m pool access ramp is not compliant with AS1428.1 *Design for Access and Mobility:*
    - There is only one handrail, whereas the standard requires two.
    - The provided handrail does not extend onto the landings at each end, nor is it provided with a kerb rail.
    - No mid-landing is present as is required under the standard.
    - The ramp delivers patrons to an area of the pool deeper than 1100mm (maximum depth as per NCC requirements)
- The entry into the ramp appears too steep and was identified as slippery.

Recommendations

- Modifying the ramp to comply involves significant reworks to the pool structure. For a long-term plan it is recommended to provide a compliant ramp, however in the short-term:

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- The slip resistance of the ramp should be investigated
- The profile of the ramp should be confirmed (primarily the ramp gradient)
- A compliant access method (such as a platform lift) should be maintained.
- Appropriate signage should be adopted to inform patrons of the ramp compliance.

Additional Photographs

Figure 17: Bottom landing of ramp

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Figure 18: Lack of mid-landing in ramp

Figure 19: Initial transition into ramp identified as slippery

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LTS POOL GENERAL ITEMS

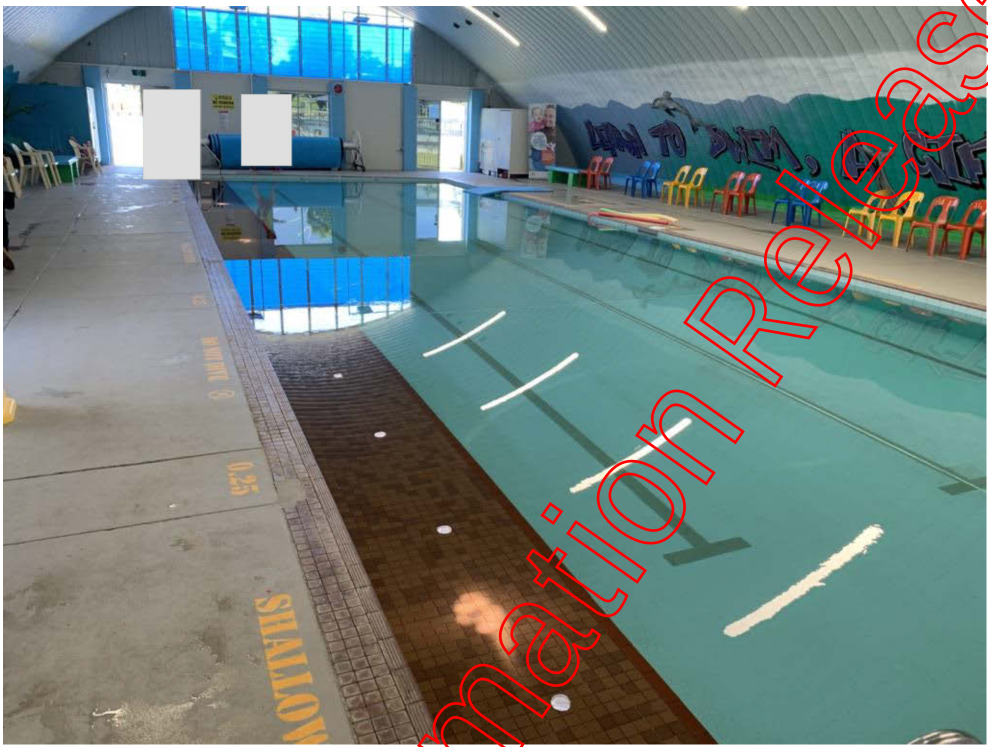

Figure 20: LTS Pool

Applicable To:

- LTS Pool

Observations

- The pool is not fitted with a compliant access point such as a ladder or steps.
- Depth markers on the vertical surface of the pool walls are half-submerged.
- The pool is not provided with slip-resistant floor finishes.
- The pool finishes are aging.
- Given the size of the pool, a maximum instantaneous bather load of 61 patrons is theoretically possible based on PWTAG requirements. A filtration system flowing at least 30 L/s would be required to support this bather load, which would not be achievable with the current hydraulic fixtures. A system flow closer to 15 L/s is more likely being achieved, limiting the bather load potential.
- Some of the lane rope anchors are not recessed, instead standing proud of the wall. These are an injury risk.

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Recommendations

- Whilst no major issues were identified with the pool structure itself, the pool is reaching end of life. Operators have advised that the patronage for the pool is now exceeding what the pool is capable of. Replacement of the pool is understood to be planned within the next 10 years. In the interim period:
    - Check slip resistance of the floor finishes
    - Rectify finishes where damage and degradation are identified
    - Remove lane rope anchors that are not flush or provide covers
    - Control bather load to maintain water quality.
    - Provide a compliant access point.

Additional Photographs

Figure 21: Skimmer in pool

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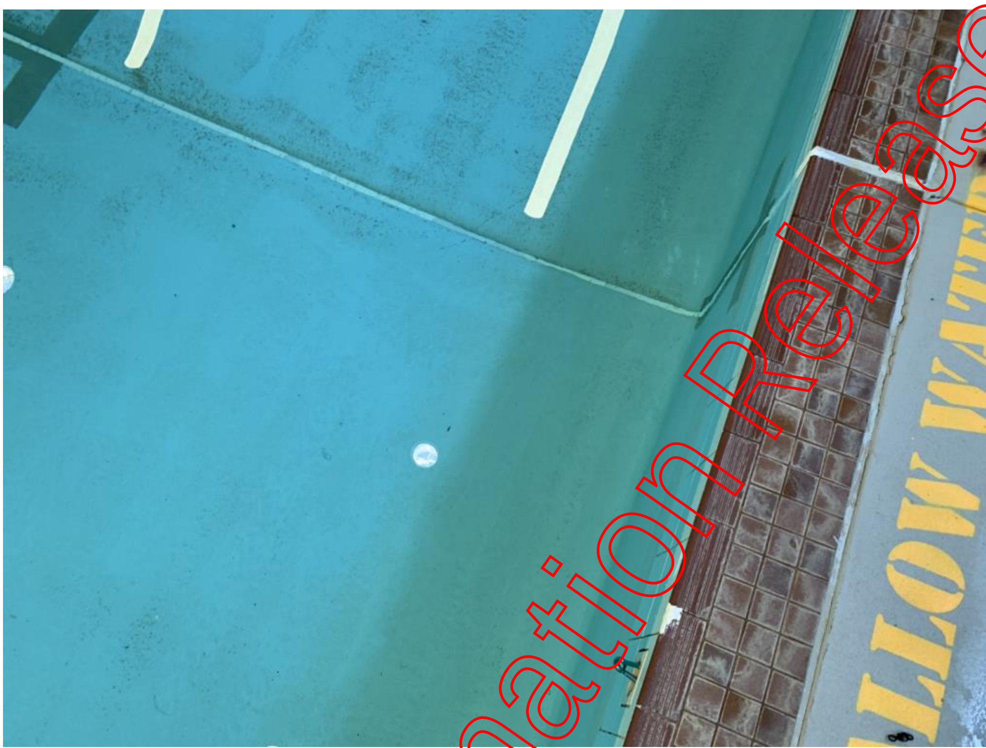

Figure 22: Failing finish on floor of pool

Figure 23: Submerged depth marker

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Figure 24: Damaged tiling, non-compliant access

Figure 25: Prominent anchor point

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Figure 26: Wearing floor finishes

Figure 27: Degraded / damaged finishes

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OUTDOOR PLAY POOL GENERAL ITEMS

Figure 28: Outdoor Play Pool

Applicable To:

- Outdoor Play Pool

Observations

- Cracks are observed in the pool structure. The majority of the cracks appear to be relatively minor cracks at the tops of the walls likely a result of under-reinforcement in the coping, however one larger crack appears to continue across the entire pool at the waterslide landing zone region.
- A set of fiberglass stairs have been added to the waterslide splash down area above a bench. These only reach the bench.
- Signage around the pool is generally lacking or incorrect. For example, a warning sign adjacent the waterslide landing area notes 'deep water' however the pool is only 900mm deep here. This may cause confusion.
- Circulation through the pool appears low in areas. A large amount of leaf material was observed in the pool and in the shallow region some of these leaves sat on the filtered water returns without moving.
- Water toys need servicing. Several blocked nozzles were observed.

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- Skimmer lids are not secure and some are cracked.
- The pool contains a mixture of old pebblecrete and new pebblecrete. The newer pebblecrete appears to be degrading, with the cement layer appearing to have been subjected to chemical attack.
- Safety suctions are provided adjacent each skimmer, assumed to be relief lines. The covers appear to be older covers and not compliant with current standards.
- The connection of the wall suctions shown in the pool and the feature system could not be confirmed. It's not sure if the system is installed in compliance with AS1926.3 *Suction Entrapment*.

Recommendations

- Undertake dye testing on the pool cracks to determine if there's leaks. Inspect the cracks closely during the dye testing to measure the width and attempt to determine if the cracking continues through the substructure or is primarily in the finishes level. Obtain specific direction following these works.
- Provide a proper ladder to the deep region of the pool.
- Undertake a signage audit as discussed later in this report.
- Undertake a circulation dye test in accordance with the Model Aquatic Health Code to identify any dead spots and rectify as required.
- Service the water toys.
- Replace all skimmer lids with secure fitting items.
- Confirm consistent water quality is being maintained in the pool, including having the pool in a slightly scale-forming state. Undertake a detailed assessment of pool finishes for condition.
- Replace all non-compliant safety suction fittings with AS1926.3 compliant covers.
- Review as-constructed documentation if located and undertake circulation and flow testing on all pool suction lines (primarily for features and skimmer balance pipes) to confirm the direct suction systems are in compliance with AS1926.3. Undertake appropriate rectifications where not.

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Additional Photographs

Figure 29: Crack across pool floor on eastern side

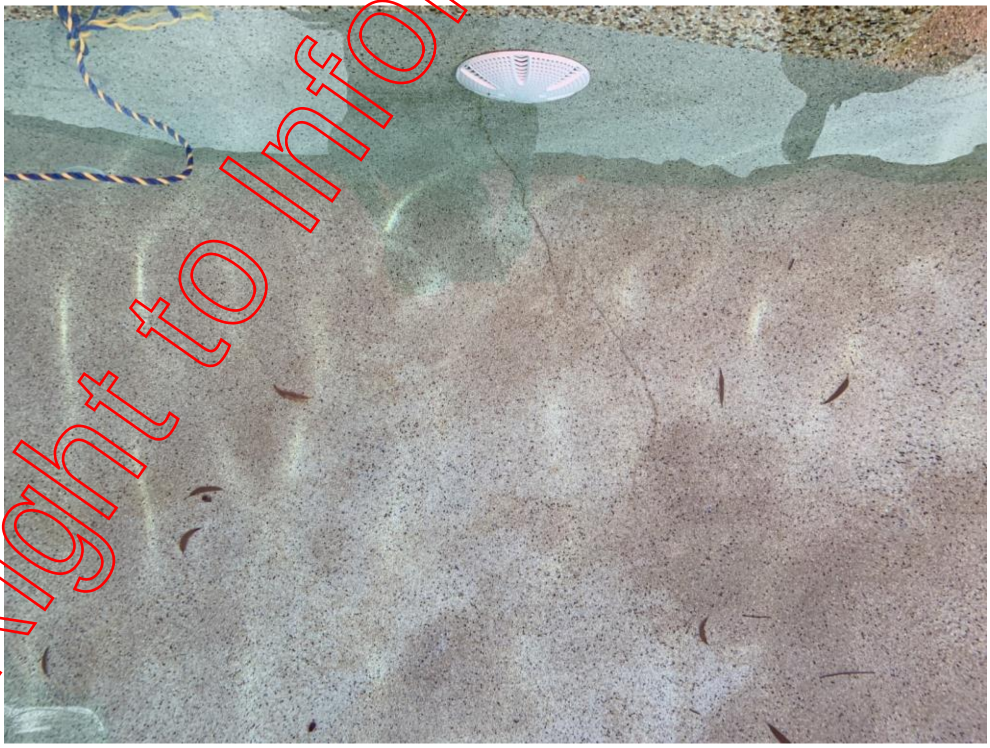

Figure 30: Crack across pool floor on western side

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Figure 31: Cracks in coping

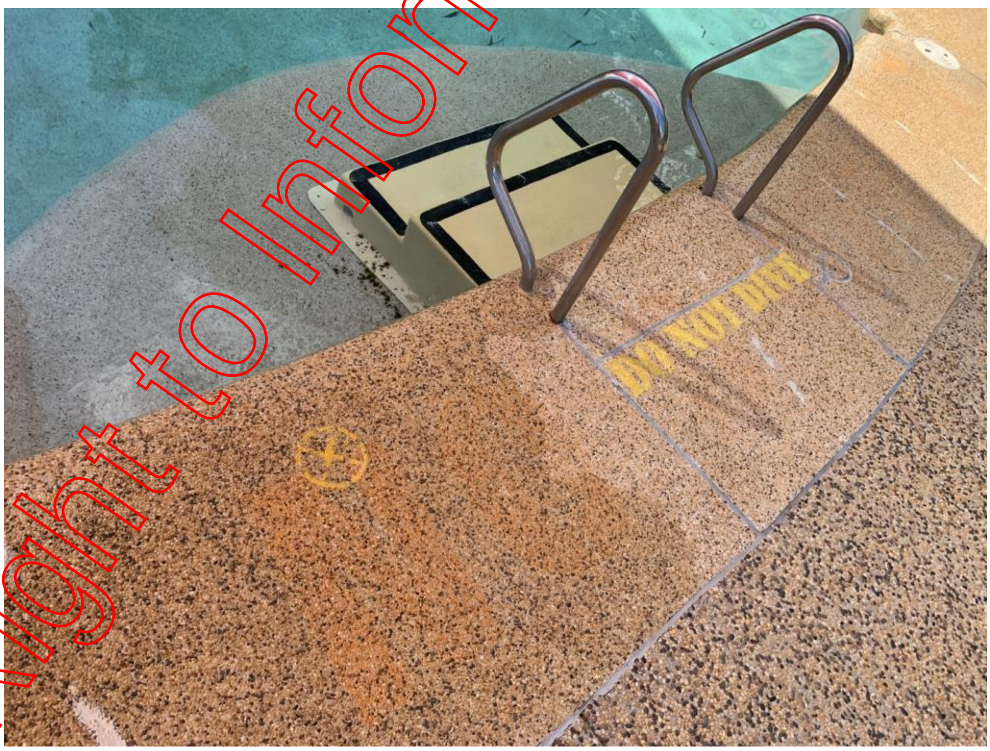

Figure 32: Cracks in coping, fibreglass stairs

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Figure 33: Broken skimmer lid

Figure 34: Leaves in deep region blown away from returns

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Figure 35: Leaves in shallow region sitting on returns

Figure 36: Deep water sign adjacent shallow water

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Figure 37: Water constantly leaking from cannon

Figure 38: Jammed bucket

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Figure 39: Older safety suction, crack in wall

Figure 40: Cracks in coping

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OUTDOOR PLAY POOL WATERSLIDE

Figure 41: Waterslide in Outdoor Play Pool

Applicable To:

- Outdoor Play Pool

Observations

- The waterslide is leaking at several of the joints.
- The access structure to the waterslide is notably rusted.
- The waterslide obstructs access around the end of the pool. People are likely to duck under the slide to get around the end of the pool, which could result in a head strike.
- The astroturf area in front of the slide access way is lumpy and a trip hazard.

Recommendations

- As a minimum, refurbish the slide and access way and undertake regular inspections of the timber support posts for rot and degradation. For long term planning, consider whether the slide is fit for purpose and the risks are considered appropriate.

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Additional Photographs

Figure 42: Leaks from slide flume

Figure 43: Rust under slide access way

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Figure 44: Rust in slide access way

Figure 45: Rust in slide access way

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OUTDOOR RIVER POOL GENERAL ITEMS

Figure 46: Outdoor River Pool

Applicable To:

- Outdoor River Pool

Observations

- A significant number of cracks are observed in the pool structure. The coping of the pool is regularly cracked with hairline cracks that appear to be relatively minor and likely a result of under-reinforcement in the coping. Several larger cracks are present in the walls of the pool which are larger than hairline that raise concern regarding the structural integrity of the pool. These cracks are vertical in the wall on the island and across the coping around the outlet grate. Additionally, a mass concrete bench is present in the pool which has large cracks at one end, indicating it is unreinforced.
- Filtered water returns in the floor of the pool have no water flow. This is likely due to the change in the filtration system, where the original filtration connections have been disconnected and the filtration system run in parallel

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with the river pumps. Resultantly, a large unmoving clump of debris is present on the floor.

- Patches of the floor finish are missing. These are typical where the pebblecrete finish has delaminated from the base concrete structure either due to age, structural movement or incorrect installation. Whilst only a couple of areas are currently present it's possible that larger regions have delaminated but have not yet cracked away. Where sharp edges are present a cut risk remains.
- The recesses in the pool floor where the jets are located are potential trip hazards.
- Signage to the pool is poor.
- No compliant access is provided into the pool. A bench is placed in front of the overflow grate assumed to be the intended access however it's too large to comply as a set of steps and is not provided with a handrail.
- The island itself is a visual obstruction to lifeguards.
- The earthing connection to the large stainless grate is broken.

Recommendations

- Undertake dye testing on the pool cracks to determine if there's leaks. Inspect the cracks closely during the dye testing to measure the width and attempt to determine if the cracking continues through the substructure or is primarily in the finishes level. Obtain specific direction following these works.
- Provide a proper access ladder to the pool, ensuring that it does not form an obstruction to patrons utilizing the river. This may be better off provided as a set of stairs constructed into the bench region with a handrail.
- Repair the failed floor finishes sections as a short-term rectification and consider full finishes replacement as a long term. For the repairs, it's recommended to drain the pool, remove any additional loose areas, make good the remaining and inspect the finishes for any other drummy sections.
- Undertake a signage audit as discussed later in this report.
- Undertake a circulation dye test in accordance with the Model Aquatic Health Code to identify any dead spots and rectify as required. This may involve reconnecting the original filtered water return lines.
- Repair the broken earthing connection
- Provide a cover system to the floor jets

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Additional Photographs

Figure 47: Numerous cracks in pool coping

Figure 48: Cracks in coping

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Figure 49: Cracks in coping, missing floor finish

Figure 50: Overflow grate with bench in front

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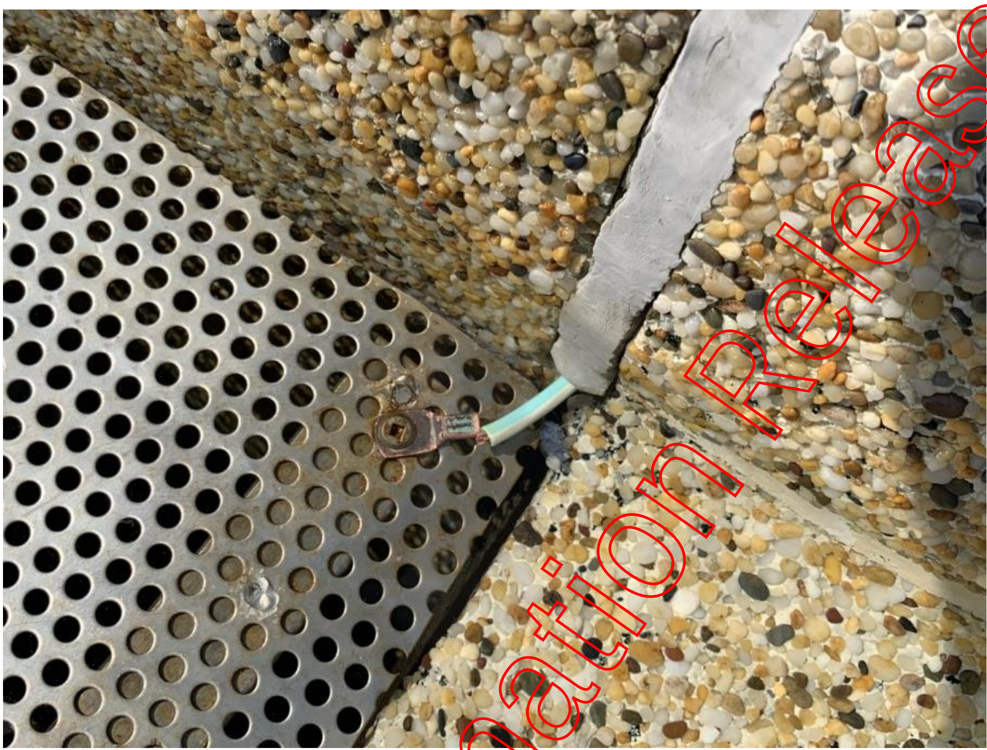

Figure 51: Broken earth connection to overflow grate

Figure 52: Cracks in pool wall

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Figure 53: Cracked bench

Figure 54: Sealed cracks at overflow chamber

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Figure 55: Missing floor finish

Figure 56: Debris accumulation in pool

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Figure 57: Jets in pool floor

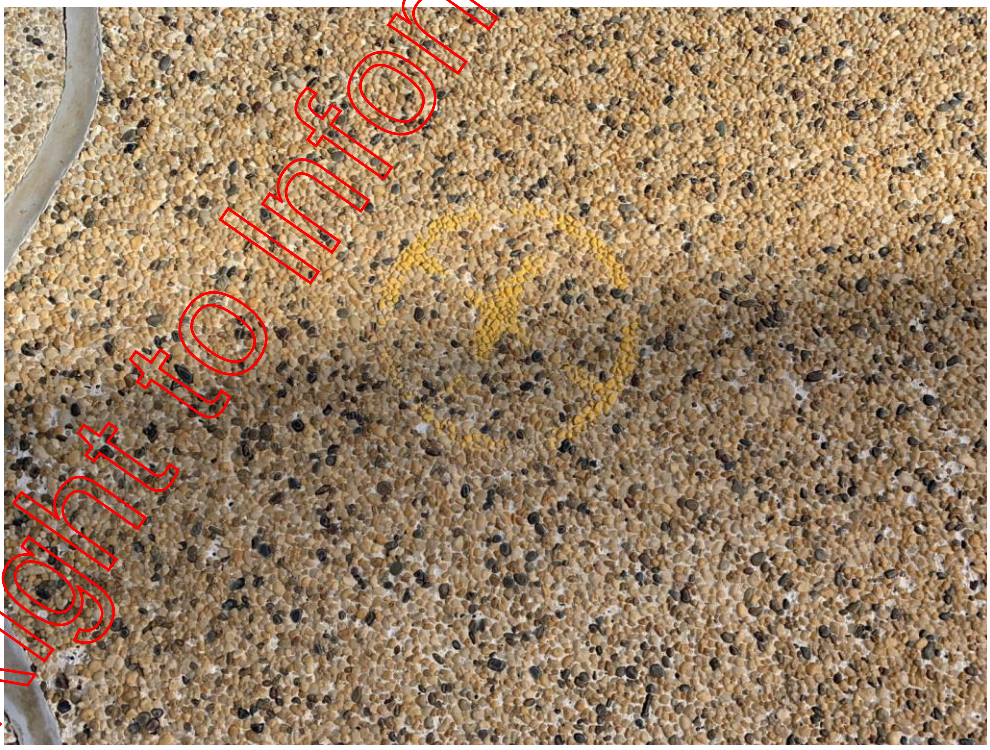

Figure 58: Faded signage

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POOL SIGNAGE

Figure 59: Signage at 25m Pool

Applicable To:

- All Pools

Observations

- Whilst warning and depth signage is present around the pools, it is not consistent and does not comply with the Royal Lifesaving Guidelines for Safe Pool Operation.

Recommendations

- Engage Royal Lifesaving (generally undertaken through Pool Star) to provide a signage audit and report. Update the signage as recommended.

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EQUIPOTENTIAL BONDING (EARTHING)

Applicable To:

- All Pools

Observations

Under AS3000 *Wiring Rules*, generally speaking all fixed conductive items that are greater than 100mm in any dimension and lie within the prescribed pool zones are to be equipotentially bonded. This means running an electrical conductor between all the items, and connecting it to the earthing system. The pool zones generally include the pool body itself as well as an area extending to a height 2.5m above the water level and a perimeter 3.5m beyond the pool waterline, however under the standards the requirement extends to the reinforcement in the pool and concourse as well.

Some indications of earth connections was observed during the inspection, however some of these were identified as degrading of broken.

Recommendations

- Engage an electrician to inspect the installation and test the conductive items to confirm firstly if earthing has been provided at all, and if so whether it passes the requirements.
- If no earthing system is present or failures are present, engage the electrician to supply and install one, taking note of the requirements under the standards as well as the issues associated with installing electrical conductors in a chlorinated environment. Stainless links to the items back to a main copper conductor system may be required.

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POOL WATER TREATMENT PLANT

NORTHERN EQUIPMENT ROOM GENERAL ITEMS

Figure 60: 50m Pool Equipment Room

Applicable To:

- 50m Pool

Observations

- The area where the chlorine truck parks for unloading bulk liquid chlorine is not a sealed surface. Should a spillage occur, it can escape to the surrounding environment.
- Labelling of pipework and valves, whilst sometimes present, is not clear, obvious and consistent. For example, heating circulation lines are unlabeled, whilst valves are just numbered without any reference diagrams provided for their use.
- The pipework to the heater circulation pumps is poorly constructed and supported.

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- Chemical storage signage is generally present, however some chemical stores for minor storage is unlabeled. Minor storage in the respective room is messy with pathway obstructions.
- The latch on the distribution board in the pump room has failed and has been replaced with a conduit clip to hold the door closed.
- The electrical installation is poor in general, with inadequate signage, disused equipment and aged components.

Recommendations

- Consider converting from bulk liquid chlorine (discussed in the *Conclusions* section) or provide a bunded truck unloading area in accordance with AS3780 *The Storage and Handling of Corrosive Substances*.
- Provide adequate signage to all chemical storage areas including the equipment room exterior and chemical dosing areas. Ensure MSDS's are located adjacent relevant chemical stores and that clear access is available to all chemics.
- Label all pipes with their flow direction and contents and label all valves clearly.
- Re-run the heater circulation pipework to be neater, correctly supported and functional.
- Engage an electrical contractor to provide a full internal condition and compliance audit on the boards and electrical installation.

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Additional Photographs

Figure 61: Chlorine unloading area

Figure 62: Crowded chemical storage, poorly labelled

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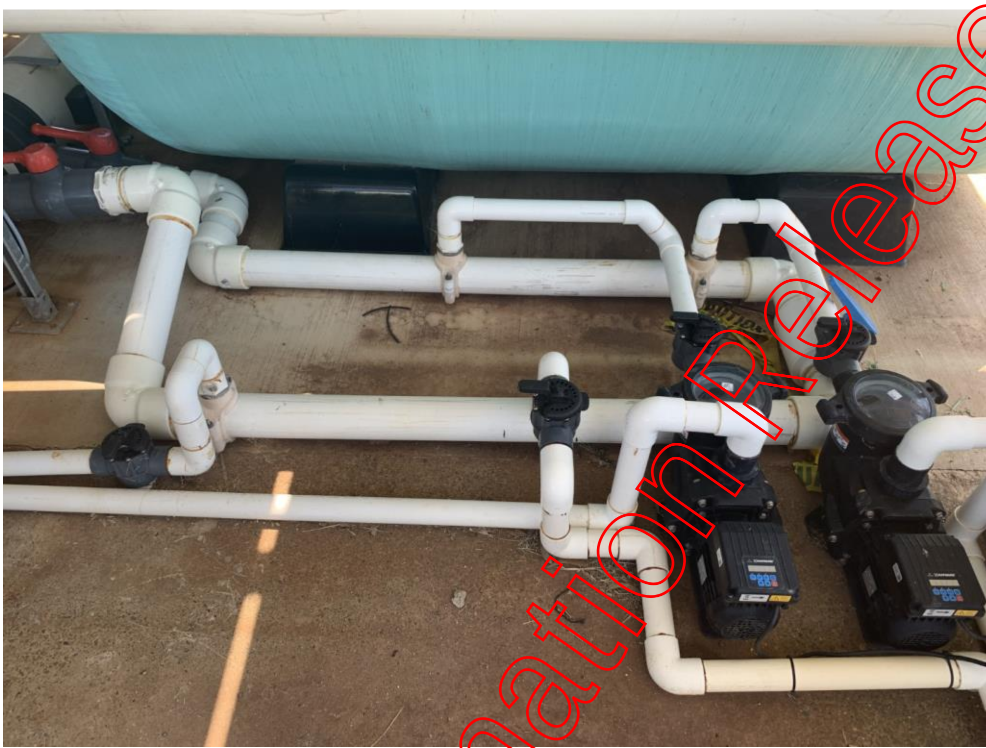

Figure 63: Unlabeled poorly configured heater pipework

Figure 64: Conduit clip to hold door closed

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Figure 65: Poorly labelled control panel

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50M POOL FILTRATION PLANT

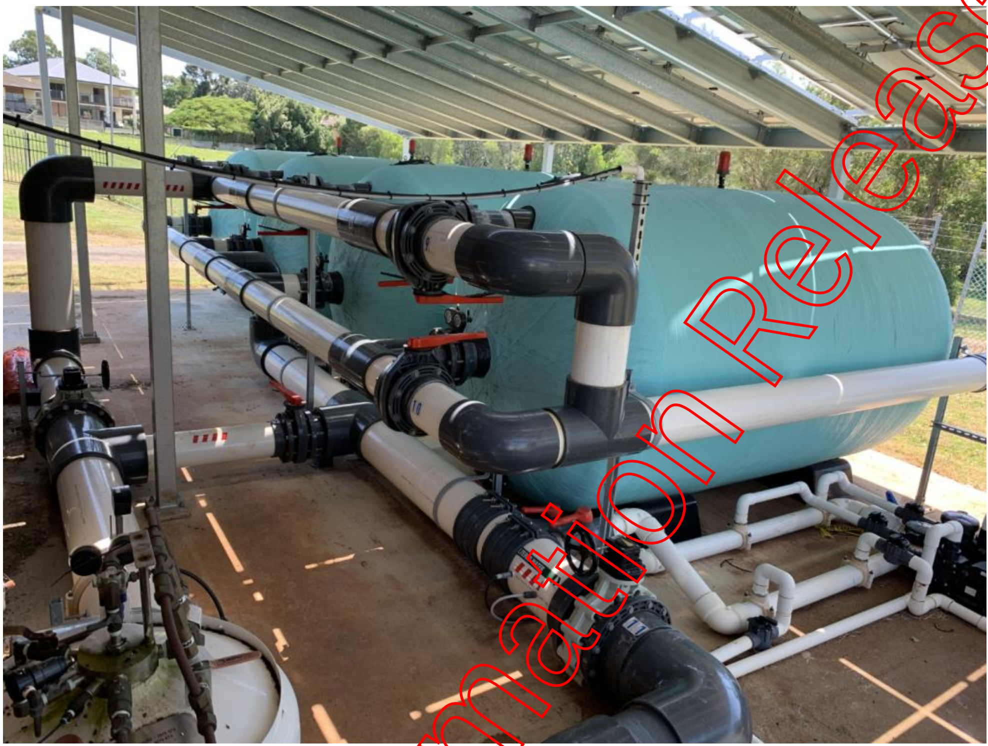

Figure 66: 50m Pool Filters

Applicable To:

- 50m Pool

Observations

- Access through the equipment area is poor, with the filtration manifold being constructed with low level trip hazards and high-level head obstructions. These items have been marked with reflective tape however still require operators to step over them.
- The filtration manifold is poorly constructed. The system main pipework is sized as DN300 whilst the filter header manifolds are sized as DN200. The pipework drops in size to the DN200 prior to the split at the manifold, needlessly increasing the system velocity and resultant friction loss. As the system flow meter is not functional verification of the actual system flow is not possible, however assuming a nominal system flow of 85 L/s (based on a 5 hour turnover for the pool) this reduction in pipework is potentially adding an additional 1.5m of friction loss to the pool filtration system.

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- The hair and lint strainer is a large unit, with the basket being difficult to remove.
- The chemical controller on the system is an obsolete Prominent brand unit. The system has limited chemical measurements, error reporting and spare parts.
- The pool heating is currently provided through Raypak direct-fired gas pool boilers. Whilst these boilers have a relatively low capital cost, they have relatively short lifespans and large ongoing operating costs.
- Pressure gauges on the filtration pumps have failed.
- The flow meter appears to have jammed and displays no flow.
- Chemical injectors are not labelled. Dosing lines are not run in conduits.

Recommendations

- Rebuild the filtration system manifold to be correctly sized and to avoid trip and head strike issues in areas through walkways.
- Review the operational procedure for removing the hair and lint basket for cleaning and consider the addition of a lifting davit.
- Provide a new chemical controller.
- Consider replacement of the gas heating system with electric heat-pumps.
- Replace failed pressure and flow measurement equipment.
- Label chemical injectors.
- Run all chemical dosing lines in sealed conduits from dosing controllers/pumps to injection points.

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Additional Photographs

Figure 67: Premature step-down of pipe size, head strike

Figure 68: Late increase in pipe size

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Figure 69: Large hair and lint pot

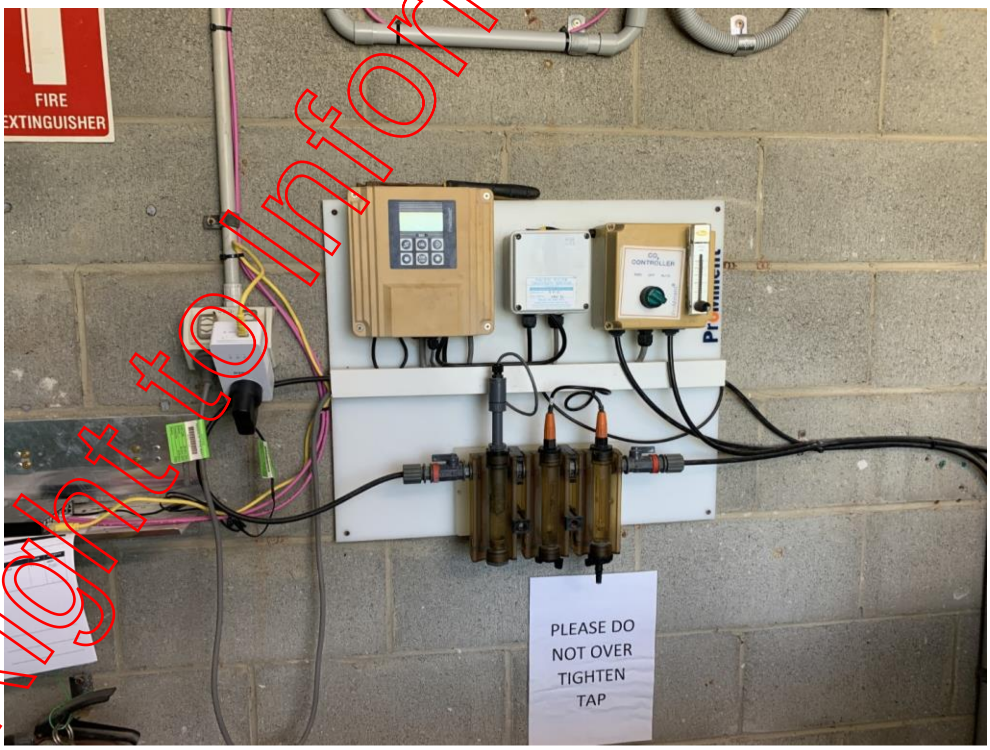

Figure 70: Obsolete chemical controller

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Figure 71: Inefficient gas boilers

Figure 72: Unlabeled chemical injectors

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Figure 73: Unprotected dosing line suspended between wall and bracket

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EASTERN EQUIPMENT ROOM GENERAL ITEMS

Figure 74: Eastern Equipment Room

Applicable To:

- 25m Pool
- LTS Pool

Observations

- As a general summary, the eastern equipment room is a poor installation that required significant reworks. Access is poor, building structures are degrading and the equipment within is poorly installed. Pipework is poorly installed and poorly supported. Numerous safety and condition issues exist, requiring significant works to overcome. The equipment areas appear to have been tacked on and grown over the life of the facility without an overall consideration to the facility use and maintenance.
- The area where the chlorine truck parks for unloading bulk liquid chlorine is in a publically accessible carpark without any spill retention measures. This creates a notable risk to health and safety should a spillage occur.
- Labelling of pipework and valves, whilst sometimes present, is not clear, obvious and consistent. For example, heating circulation lines are

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unlabeled, whilst valves are just numbered without any reference diagrams provided for their use.

- The latch on the UV control panel in the pump area has failed with tape holding the door shut. Electrical equipment is exposed behind the door.
- The electrical installation is poor in general, with inadequate signage, disused equipment and aged components.
- The chlorine storage tank produces several compliance and condition issues:
    - No tank vent or overflow are provided as per AS3780
    - No labelling is provided on the tank as per AS3780 such as volume indicators
    - The bund is in poor condition, unlikely to be sealed in the event of a spill.
    - The fill point for the tank is poorly supported and may break during a tank fill.

Recommendations

- Consider replacement of the entire equipment room with a properly designed room considering actual equipment size requirements (to suit correct equipment for 25m and LTS), access pathways, chemical storage, chemical unloading and the like.
- Consider converting from bulk liquid chlorine (discussed in the *Conclusions* section) or provide a full refurbishment to the chlorine storage including new tank and bund as well as a bunded truck unloading area in accordance with AS3780 *The Storage and Handling of Corrosive Substances*.
- Provide adequate signage to all chemical storage areas including the equipment room exterior and chemical dosing areas. Ensure MSDS's are located adjacent relevant chemical stores and that clear access is available to all chemics.
- Label all pipes with their flow direction and contents.
- Engage an electrical contractor to provide a full internal condition and compliance audit on the boards and electrical installation.

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Additional Photographs

Figure 75: Poor access through equipment room

Figure 76: Poor condition external equipment, unsafe access to manifold

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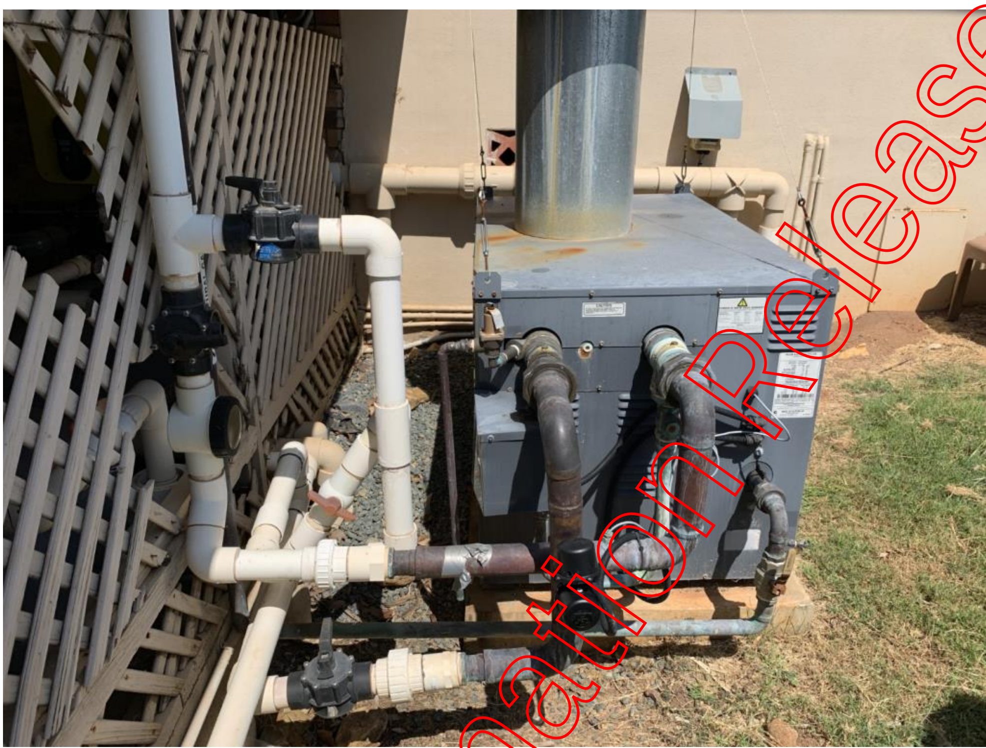

Figure 77: Poorly installed and supported pipe

Figure 78: Poorly installed and supported pipe

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Figure 79: Poorly installed pipework, inaccessible multiport valve

Figure 80: Rusted pipe supports, unsupported pipework

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Figure 81: UV Degraded external equipment

Figure 82: Failed door hinge, poor building condition

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Figure 83: Public carpark where chlorine truck unloads

Figure 84: Unlabeled equipment in equipment room, loose extension cord

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Figure 85: Unsafe working surface between plant and truck unloading area

Figure 86: Obstructed main distribution board

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Figure 87: Open UV control panel with broken latches

Figure 88: Poor condition bund wall

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Figure 89: Poorly installed signage on broken door

Figure 90: Tank with no level markings or solid plumbing connections

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Figure 91: Poor condition bund with debris

Figure 92: Disused equipment, open inlet to tank

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25M POOL FILTRATION PLANT

Figure 93: 25m Pool Pump and Filters

Applicable To:

- 25m Pool

Observations

- Whilst flow measurement equipment on the pool was not functional at the time of the inspection (reading 2,100 L/m which is far from achievable given the current installation), the system flow is expected to be significantly lower than what is required for this pool.
    - The pool is approximately 25m x 13m, with a nominal volume of or around 370 m³. Applying a four-hour maximum turnover for the pool, a minimum system flow of 25.7 L/s should be provided.
    - The two DN80 suction pipes flowing from the skimmers are limited to around 10 L/s each. The pipes then tee together into a single DN80 before entering the pump, further limiting the system flow.

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- The system is provided with 3 x 1200mm filters, which have a maximum flow of 11.4 L/s each. Whilst this flow rate is acceptable for the required flow, the 50mm multiport valves on each filters severely limit the system flow. Additionally, access to the multiport valves for maintenance is very poor and has the potential to break poorly installed pipework as people climb over the pipework to reach the valves.

- The filtration pump baseplate is rusty. The pump is not provided with no-flow protection, which may result in a pump burnout.
- The backwash lines from the filters discharge to a floor waste in the equipment room instead of the backwash holding tank. It's not known where this floor waste drains to.
- The chlorine dosing pump is not labelled, has an inaccessible injector and has an overpressure line that discharges to the room adjacent the pump. If the injector becomes blocked, chlorine will be discharged into the room.

Recommendations

- Provide reliable flow monitoring equipment and confirm the system flow.
- As part of the equipment room replacement, provide a new correctly designed filtration system, rated to suit the required flow for the pool. Pipework upgrades to the pool may be required for this. Due to the numerous issues with access, pipework configuration and the like, minor refurbishment works are difficult to provide.
- Divert the backwash to the holding tank.
- Rectify the chlorine dosing pump situation.

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Additional Photographs

Figure 94: Restriction in filtration pump inlet

Figure 95: Filtration pump installed direct to slab, rusty baseplate

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Figure 96: Backwash to floor drain, trip hazards

Figure 97: Chlorine dosing pump, overpressure line discharging to room

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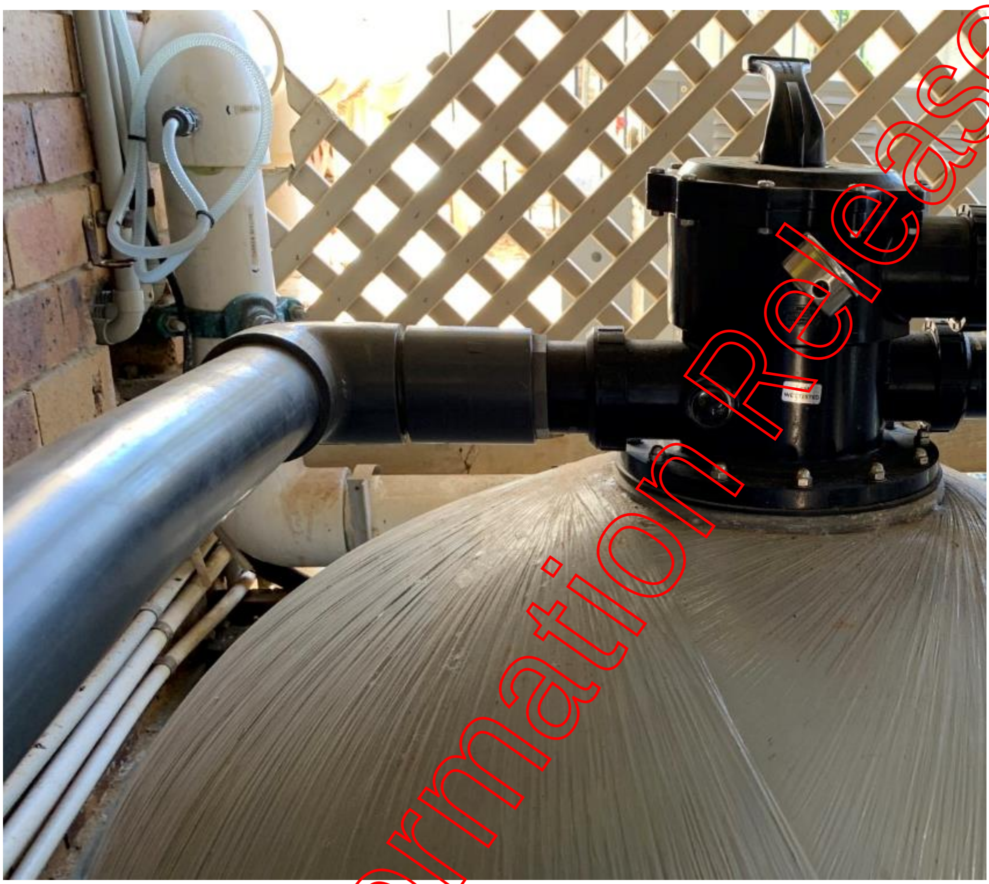

Figure 98: Inaccessible chlorine injector

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LTS POOL FILTRATION PLANT

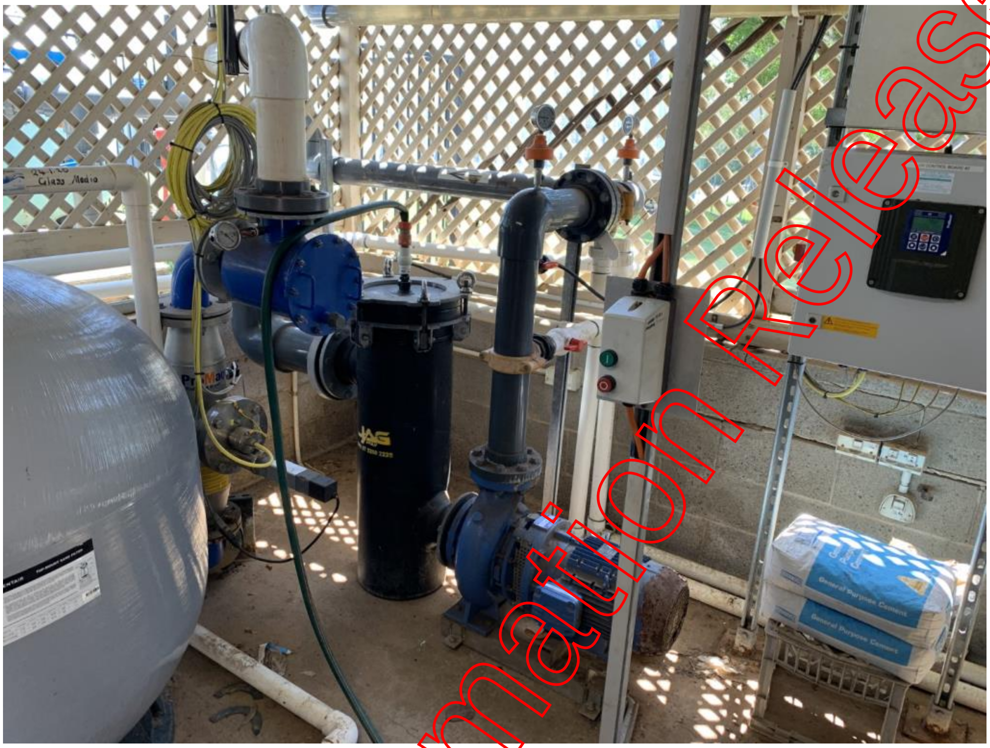

Figure 99: LTS Pool Pump and UV Unit

Applicable To:

- LTS Pool

Observations

- Flow measurement equipment on the pool was reading approximately 900 L/min at the time of the inspection. Whilst calibration of the flow meter is not confirmed, this flow is a reasonable flow to expect for the system. Regarding required flow for this pool:
  - The pool is approximately 20m x 6.8m, with a nominal volume of or around 124 m³. For a learn to swim pool, a turnover of between 1 to 2 hours should be provided depending on bather loads for the pool. This requires a filtration system flowing between 17 to 34 L/s.
  - If the current system is flowing around 15 L/s, whilst this is longer than the Queensland Health maximum recommended turnover time, it is only marginally longer. This flow would be

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considered appropriate for a maximum bather load of 31 patrons and an average hourly bather load of around 8 patrons.
    - The primary limitation in the pool appears to be the pool skimmers, which are nominally rated to 5 L/s each. Increasing the system flow to support higher bather loads would require major replacement of the hydraulic plumbing components.
- The filtration strainer has a solid lid. Operators must remove the lid to inspect the strainer internals.
- Access to the filters is poor. The filters are degrading from UV exposure. A leak is present in the manifold.
- The filtration pump is rusty and is not provided with inlet or outlet valves. The pump is not provided with no-flow protection, which may result in a pump burnout.
- The chlorine dosing pump is not labelled, has an inaccessible injector and is not fitted with a multifunction valve (overpressure relief / anti-siphon).

Recommendations

- Provide reliable flow monitoring equipment and confirm the system flow.
- As part of the equipment room replacement and LTS pool replacement, provide a new correctly designed filtration system, rated to suit the required flow for the pool. Due to the numerous issues with access, pipework configuration and the like, minor refurbishment works are difficult to provide.
- Rectify the chlorine dosing pump situation.

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Additional Photographs

Figure 100: Pool filters with unsafe access, UV degradation to filters

Figure 101: Poor condition pump motor

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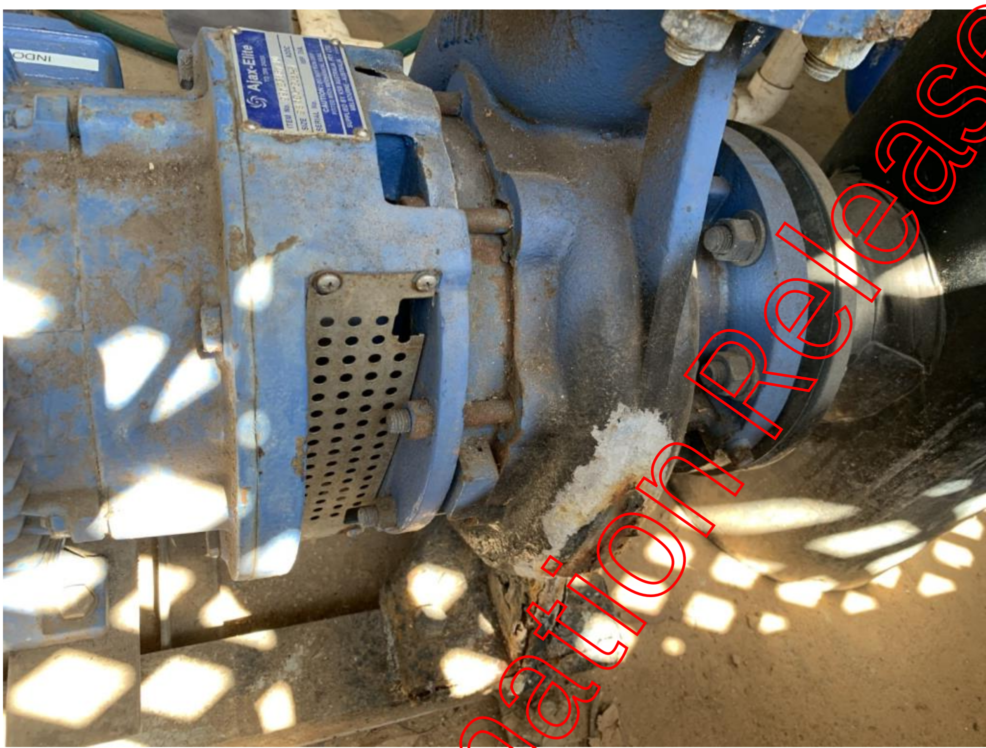

Figure 102: Poor condition pump housing

Figure 103: Leak in pipework

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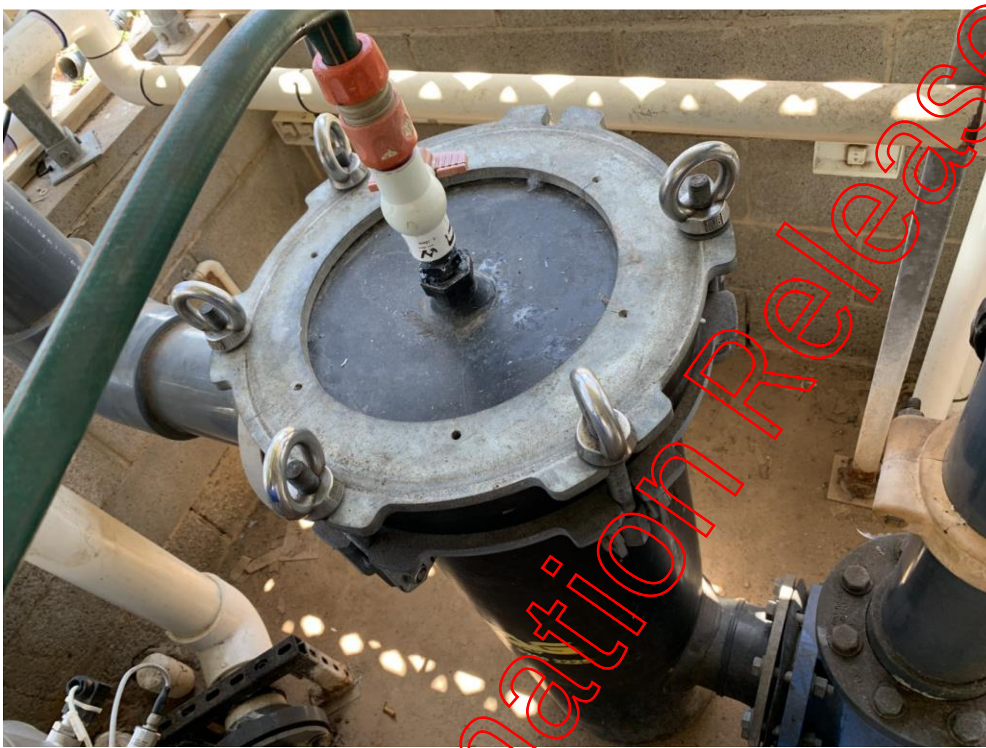

Figure 104: Solid lid on strainer

Figure 105: Chlorine injection point

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Figure 106: Chlorine dosing pump with no multifunction valve

Figure 107: UV degraded filter

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WESTERN EQUIPMENT ROOM GENERAL ITEMS

Figure 108: Western Equipment Room

Applicable To:

- Play Pool
- River Pool

Observations

- The area where the chlorine truck parks for unloading bulk liquid chlorine is not a sealed surface. Should a spillage occur, it can escape to the surrounding environment.
- Labelling of pipework and valves, whilst sometimes present, is not clear, obvious and consistent. For example, heating circulation lines are unlabeled, whilst valves are just numbered without any reference diagrams provided for their use.
- The pipework to the heater circulation pumps is poorly constructed and supported.
- Chemical storage in the room is poor.

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- The electrical installation is poor in general, with inadequate signage, disused equipment and aged components. Cable trays are rusting and the switchboard contains obsolete equipment.
- A drip tray is provided below the chemical measurement and dosing area. Both chlorine and acid injectors are present, meaning that if a leak occurs in both and acid and chlorine line the incompatible substances can mix and cause a dangerous environment.
- The acid storage is poor in general.
- The main river pumps and play pool filtration pump are located in a submerged pump well, accessible via a ladder. Access around the pumps does not comply with workplace health and safety requirements.
- Obsolete equipment is present in the room.
- There's a concrete pad outside the equipment room however the ground has subsided around it. This generates a trip hazard.
- Flow meters are installed on the systems between filters 2 and 3. Resultantly, the meters are not reading the full flows of the systems. The operators have reported that the flow meters are unreliable.
- Pipework support is inadequate, with filter manifolds practically unsupported.
- No positive ventilation system is present to the plant room. Many items inside are corroded.
- Chemical injection points are not labelled.
- The chlorine storage tank produces several compliance and condition issues:
    - The tank vent discharges to the room instead of the plant room exterior.
    - No dedicated overflow is provided.
    - No camlock coupler is provided on the tank fill point. Instead, the operator holds the hose in through the tank lid for filling which is highly dangerous.
    - No labelling is provided on the tank as per AS3780 such as volume indicators

Recommendations

- The access issues around the pumping area are difficult to resolve due to the elevated location of the equipment room. Raising the pumps up to floor

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level would be ideal however may introduce cavitation and priming issues. As an ideal solution, the pumps would be relocated to a new equipment enclosure down at the deck level of the pool, with good access provided around all equipment.

- Consider converting from bulk liquid chlorine (discussed in the *Conclusions* section) or provide a bunded truck unloading area in accordance with AS3780 *The Storage and Handling of Corrosive Substances*.
- Provide adequate signage to all chemical storage areas including the equipment room exterior and chemical dosing areas. Ensure MSDS's are located adjacent relevant chemical stores and that clear access is available to all chemics.
- Label all pipes with their flow direction and contents.
- Engage an electrical contractor to provide a full internal condition and compliance audit on the boards and electrical installation.
- Update the chlorine storage tank to comply with relevant codes.
- Relocate the acid dosing systems to the opposite end of the plant room to remove the risk of cross contamination. Improve the acid storage.
- Remove all obsolete equipment.
- Fill around the concrete step.
- Replace the flow meters and provide in the correct locations to measure full flow of the systems.
- Provide pipework supports in accordance with pipe supplier instructions so that no load is placed on equipment from pipework.
- Provide a mechanical ventilation system.
- Label all chemical injection points.

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Additional Photographs

Figure 109: Submerged pump well, poor access

Figure 110: Chlorine tank with no fill point, overflow or level markings

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Figure 111: Chemical control and dosing area with disused equipment

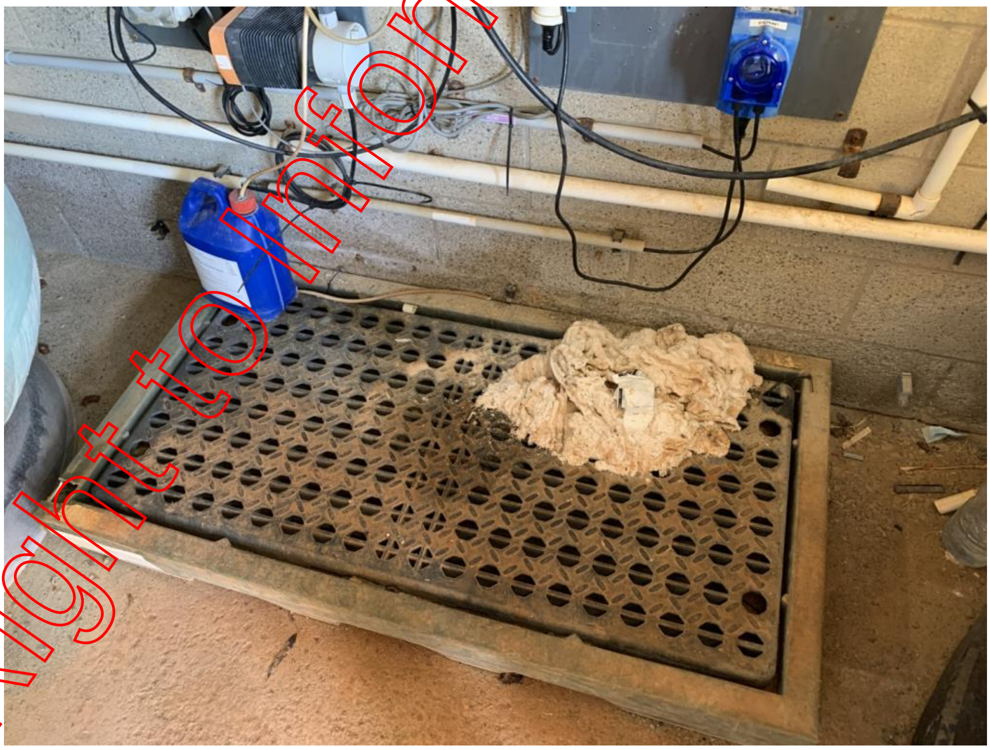

Figure 112: Chemical tub below dosing area

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Figure 113: Stairway into pump well with no access at bottom

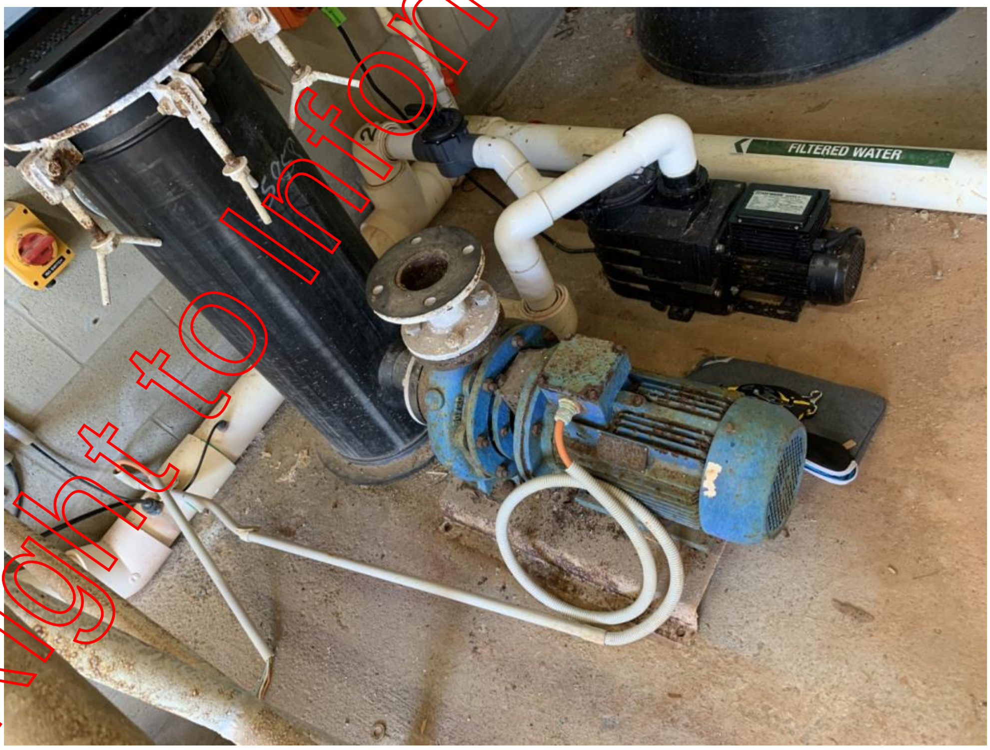

Figure 114: Disused equipment in room

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Figure 115: Obsolete equipment, poorly labelled pipework, disconnected heater pipework

Figure 116: Poorly managed acid storage

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Figure 117: Flow meter installed in wrong location

Figure 118: Inadequate pipe supports in filter manifold

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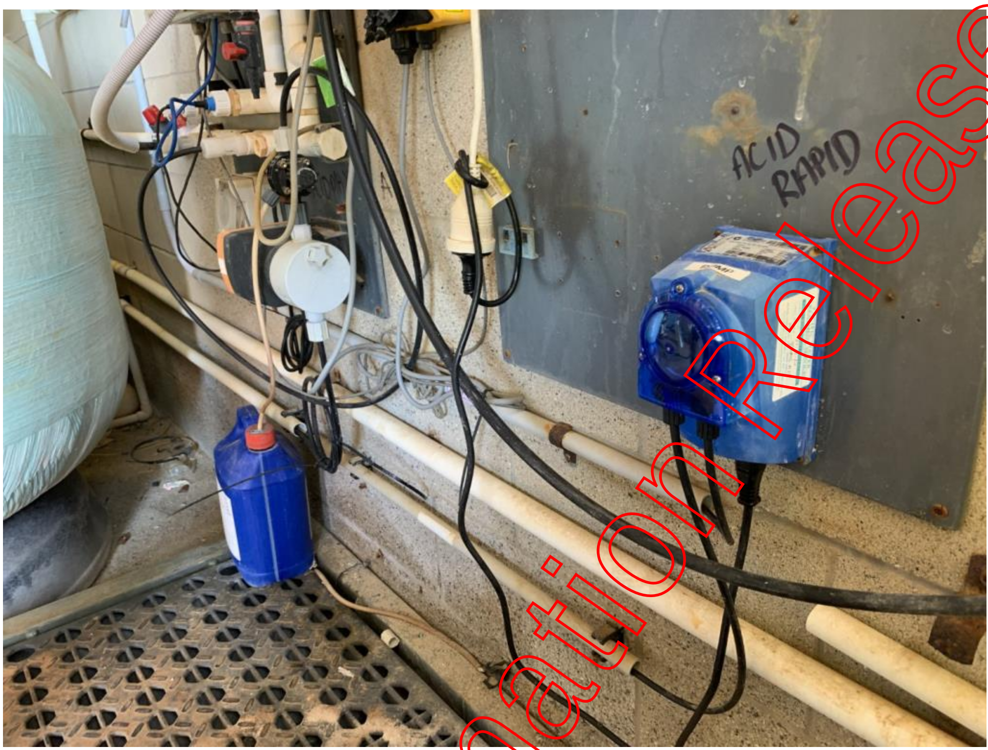

Figure 119: Poorly labelled and installed equipment

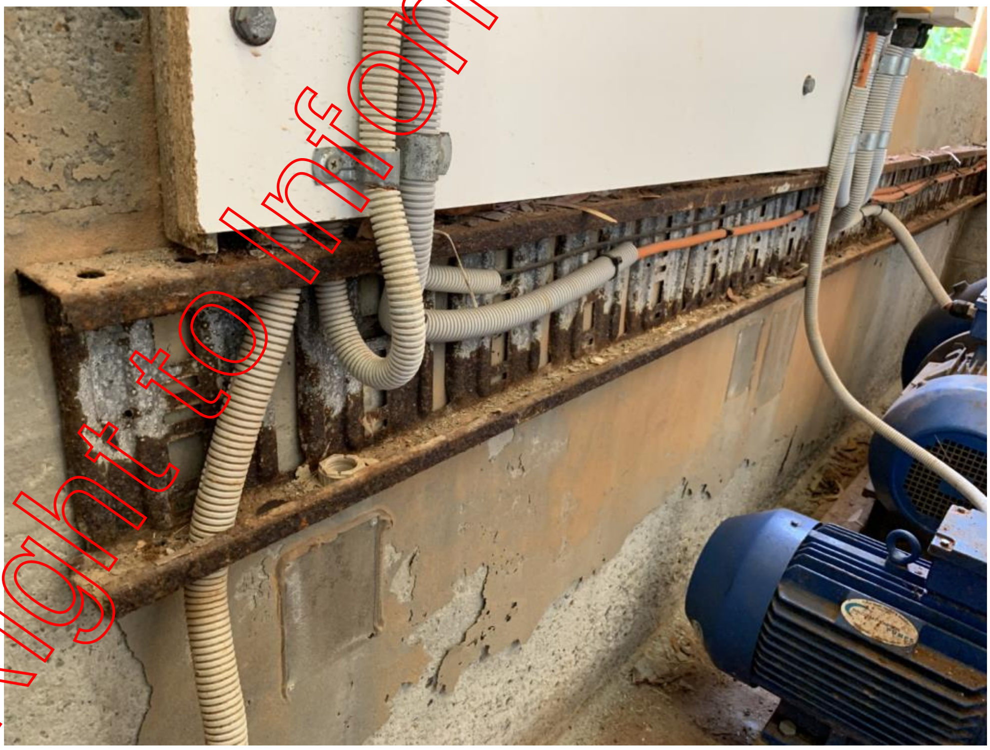

Figure 120: Rusty cable tray

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Figure 121: Obsolete switchgear for spa in board

Figure 122: Electrical Cabling

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PLAY POOL FILTRATION PLANT

Figure 123: Play Pool Filters

Applicable To:

- Play Pool

Observations

- Flow measurement equipment on the pool was reading approximately 1000 L/min at the time of the inspection. Given the flow meter location this would be approximately 2/3 of the filtration flow, so a total of 1500 L/min. Whilst calibration of the flow meter is not confirmed, this flow is a reasonable flow to expect for the system. As the pool volume is not currently known due to the freeform nature of the pool and the lack of as-constructed drawings, it is not possible to comment regarding the suitability of this flow.
- The filtration pump is rusty and is not provided with inlet or outlet valves. The pump is not provided with no-flow protection, which may result in a pump burnout. Access to the pump and strainer is very poor.
- Heating for the pool is currently shut down, with the heaters in poor condition. It's not known as to why.
- At the time of the inspection the chemical controller was not operational. It's understood that since then a replacement has been ordered.
- The acid dosing pump injects into a local dosing loop, with the overpressure line discharging to a local 5L drum. This is a poor configuration.

Recommendations

- Provide reliable flow monitoring equipment and confirm the system flow.
- Consider relocation of the pump to a more appropriate location as discussed above.
- Relocate acid dosing pumps, lines and storage to the opposite end of the equipment room and neaten up overall.

Additional Photographs

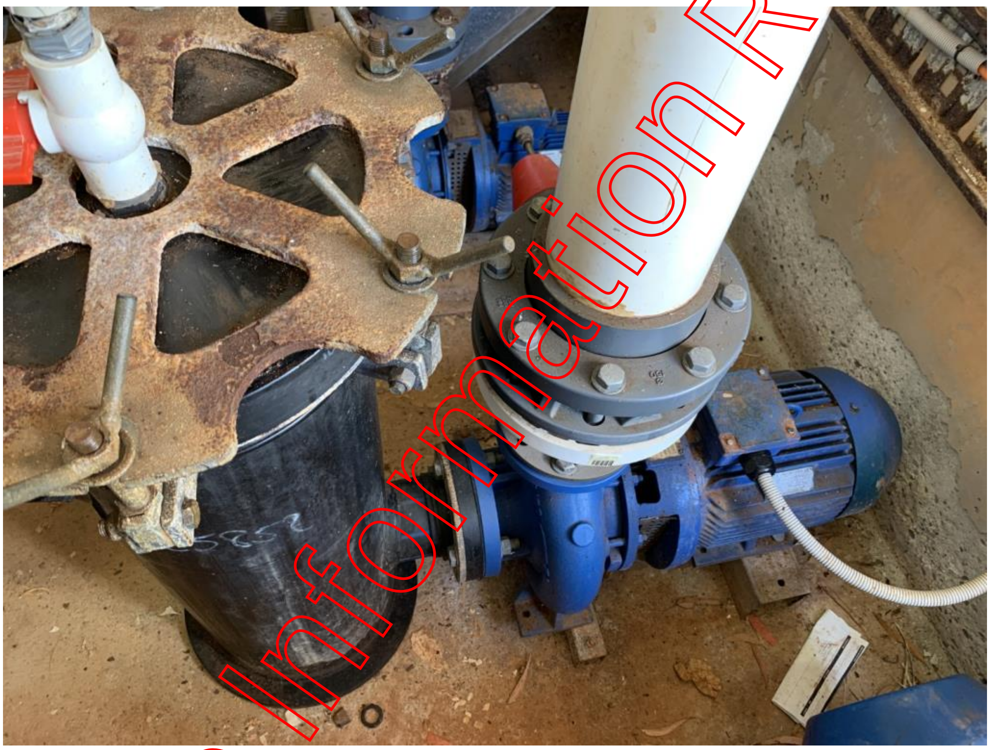

Figure 124: Filtration pump

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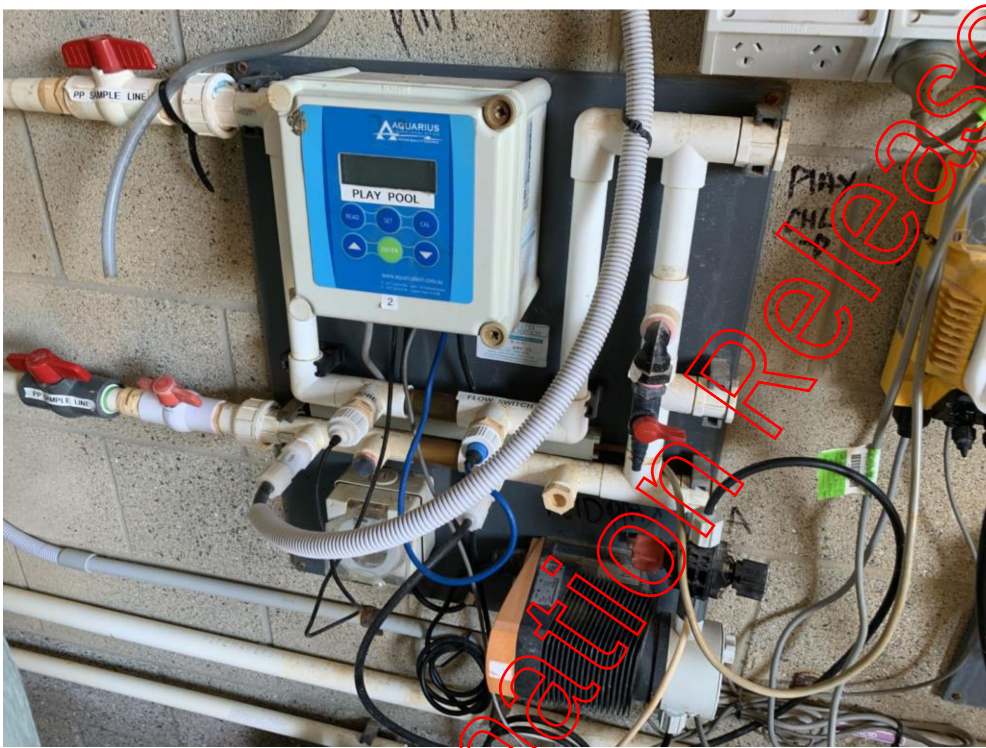

Figure 125: Play pool acid pump and chemical controller

Figure 126: Play pool heaters

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RIVER POOL FILTRATION PLANT

Figure 127: River Pool Filters

Applicable To:

- River Pool

Observations

- Flow measurement equipment on the pool was reading approximately 1500 L/min at the time of the inspection. Given the flow meter location this would be approximately 2/3 of the filtration flow, so a total of 2250 L/min. Whilst calibration of the flow meter is not confirmed, this flow is a reasonable flow to expect for the system. As the pool volume is not currently known due to the freeform nature of the pool and the lack of as-constructed drawings, it is not possible to comment regarding the suitability of this flow.
- The filtration pump is rusty. The pump is not provided with no-flow protection, which may result in a pump burnout. Access to the pump and strainer is very poor.
- The features pumps are also rusty, with poor access and not provided with no-flow protection. The operators have reported difficulties in obtaining prime.

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- Heating for the pool is currently shut down, with the heaters in poor condition. It's not known as to why.
- Some obsolete pipework is present, mainly due to the heating disconnection and the integration of the spa filter into the system.
- The chlorine dosing pump is located overhead which increases the risk of chlorine contact with maintenance personnel.

Recommendations

- Provide reliable flow monitoring equipment and confirm the system flow.
- Consider relocation of the pumps to a more appropriate location as discussed above.
- Relocate the chlorine dosing pump.
- Relocate acid dosing pumps, lines and storage to the opposite end of the equipment room and neaten up overall.

Additional Photographs

Figure 128: Filtration pump and strainer, poor condition, poor access, disused pipe

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Figure 129: River pump 1, poor access

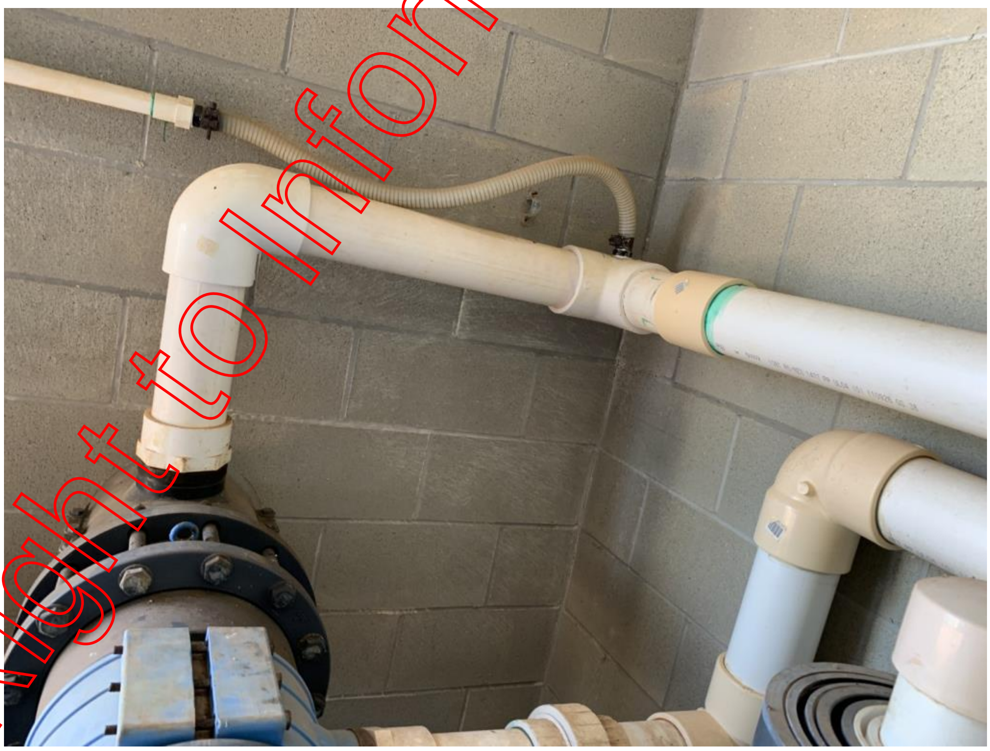

Figure 130: Filtration suction and return connections from river pump

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Figure 131: Spa filter incorporated into main manifold

Figure 132: Disused heating

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Figure 133: Flow meter installed upstream of filter

Figure 134: Chlorine pump installed at high level

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Figure 135: Disused boost pump, possibly for waterfall

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CONCLUSION

Overall, the facility is aged and presents several non-compliances with current standards, codes and practices. Issues requiring immediate attention have been identified, however as a whole the balance must be weighed between bringing individual components of the existing system up to standard versus replacing the entire system. There are several factors that must be considered.

50M POOL

Whilst dated, the 50m pool appears to be generally fit for purpose. The operators report the ability to maintain water quality in the pool, and whilst the circulation through the pool is suspected to be poor the heavy use the pool receives may be aiding in providing a natural form or circulation.

Improvements are required to the chemical storage and handling systems to overcome relatively small issues identified. Rectifying the gutter issue additionally is recommended to reduce the potential for ankle injuries.

The cost of heating of the pool is suspected to be high, as discussed later in this section. It's understood that electrical supply costs to site are relatively cheap, favouring heat pumps as a solid long-term option for heating of the pool.

The liquid chlorine system onsite does present some minor non-conformances, with the cost to rectify being notable. For example, provision of a concrete hardstand for unloading bulk chlorine could be in the order of $70,000 to $100,000. Large public lap pools often adopt salt electrochlorination as the primary form of sanitation as whilst there is a capital cost in the order of $150,000 to $200,000, the operating costs are typically lower and the intrinsic safety through removing bulk quantities of a corrosive substance onsite is an important consideration.

OUTDOOR 25M POOL

The outdoor 25m pool is a heavily utilized pool for the centre, and resultantly this pool should be one of the higher quality installations. Unfortunately the current offering is poor in condition and water quality, with notable improvement recommended.

The filtration plant provided is limited in performance. Conservatively estimating a filtration flow or around 15 L/s based on pipework limitations, the resultant turnover in the pool may be in the order of 6 to 7 hours. This turnover is too long for

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a pool of this nature, with Queensland Health guidelines requiring a 4 hour turnover as a maximum and possibly a shorter turnover again depending on required bather loads for the pool. Poor filtration performance is evidenced by the cloudy water.

The filtered water return pipework can support the required flow however the soiled water suction pipework is potentially limiting. Regardless of this, inefficiencies in the plumbing within the pool plant room can be relatively easily rectified to maximise the potential of the system however the current poor configuration of the plumbing and equipment requires addressing to overcome the safety issues detected. Ultimately, demolishing the current equipment room and reconstructing a new room with better layouts and configurations of equipment is likely the most practical solution to overcome a large portion of issues experienced with the plant.

Regarding the pool interior finish, the current finish is a relatively low-cost system, with the history of the installation being unknown. The results of such a system are being experienced such as short lifespans. Given this pool is a heavily utilized elements, though should be given towards a major refurbishment of the pool. Access provisions around the pool are difficult to rectify as well due to current restrictions on space, but are important to consider as part of an overall refurbishment to remove safety concerns.

INDOOR LTS POOL

Despite being aged, the indoor LTS pool structure does not present any major areas of concern. Hydraulically, the filtration system is limited for how LTS pools are typically operated in current times and presents several safety and compliance issues. It's understood that a new LTS pool is proposed for construction in the next 10 years. Resultantly, the existing installation requires safety rectifications to overcome identified issues but generally can be placed into a 'limp-home' approach towards maintenance and repairs. Ensuring a solid risk management strategy is adopted is key in providing safe water for patrons in the interim period.

As with the other pools, it's recommended to improve online system flow and chemical monitoring to identify poor water quality.

Regarding the plant installation, the selection of equipment and pipework sizing is of a higher grade than the 25m pool sharing the same room, however access around the equipment is limited and degradation of the room structure applies as well. In the recommended replacement of the room structure itself for the eastern equipment room, a reorganization of the LTS pool equipment into a new room could

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possibly be provided to overcome the compliance issues, factoring in the proposed replacement of the LTS pool overall.

OUTDOOR PLAY POOL

The outdoor play pool is a relatively unusual pool for a public aquatic centre however provides functionality and a reasonable use. Public waterslides always contain intrinsic risk due to the uncontrolled movement during the slide, but provided these risks are managed and operation is supervised then slides can be a great attractor.

The structural condition of the pool raises some concerns. The numerous cracks in the coping appear to generally be hairline cracks and likely a result of under-reinforcement in the original construction of the pool. The same cracking is observed in the river pool which was constructed at the same time. Generally hairline cracking is not a major concern provided that leaks aren't present and the reinforcement isn't subjected to chlorinated water. Of larger concern is the larger crack that runs across with width of pool, as this is likely to be structural. It may be a location where reinforcement laps were present and insufficient in length or it may be indicative of foundation issues with the deeper section of the pool. Measuring and monitoring the crack is the primary method of inspecting for the interim period.

The equipment room's location elevated above the pools is less than ideal, however the systems appear to operate. The primary issue associated with this elevation is pump priming and suction issues, however with correct pump selection and installation these can be managed as they appear to have been. An overall refurbishment of the plant is recommended to overcome the numerous smaller issues that add up to an overall higher risk of installation than what is typically required for such an installation.

OUTDOOR RIVER POOL

The outdoor river pool contains a large amount of structural cracking as well as intrinsic risks associated with high energy water movements, poor access and trip hazards in the river pathway. These items can be rectified, however the long-term viability of the pool requires a high-level review. The circulation pumps are significant in size requiring a reasonable quantity of energy to operate.

The filtration plant presents similar issues and concerns to that of the outdoor play pool.

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ADDITIONAL ITEMS

Not currently covered but to be addressed in the following revision of this report:

1. Discussion on replacement of chemical controllers
2. Discussion on system parameter monitoring
3. Discussion on converting gas heaters on 50m pool to heat pump
4. Identification of key performance parameters
5. Asset registers of existing equipment

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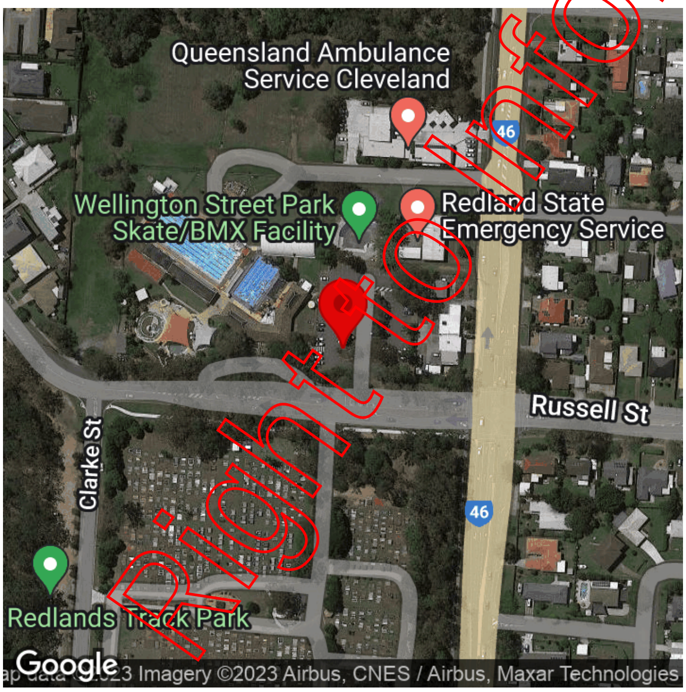
Aquatic Centre Condition Audit

Condition and compliance audit for an existing aquatic centre

Cleveland Aquatic Centre, July 19, 2023



CREATED

7/18/2023, 8:33:50 PM GMT+10
by Luke Bartlett

UPDATED

7/24/2023, 3:35:01 PM GMT+10
by Luke Bartlett

LOCATION

-27.529104, 153.254576

PROJECT

No Project

AUDIT DETAILS

Audit Reference	Cleveland Aquatic Centre
Job Number	0336
Audit Date	July 19, 2023
Auditor	

FACILITY DETAILS

Facility Name	Cleveland Aquatic Centre
Facility Address	222 Russell St, Cleveland Qld 4163
Facility History	The facility is understood to have originally opened in the early 1970's, with the 25m pool being added in the mid-90's. The dates for the play pool and river pool are not known but are suspected to be constructed around a similar time. Relatively little as-constructed documentation of the elements in the facility was available for viewing at the time of the inspection, primarily covering the 50m pool only.

Key Photos

AQUATIC FACILITIES

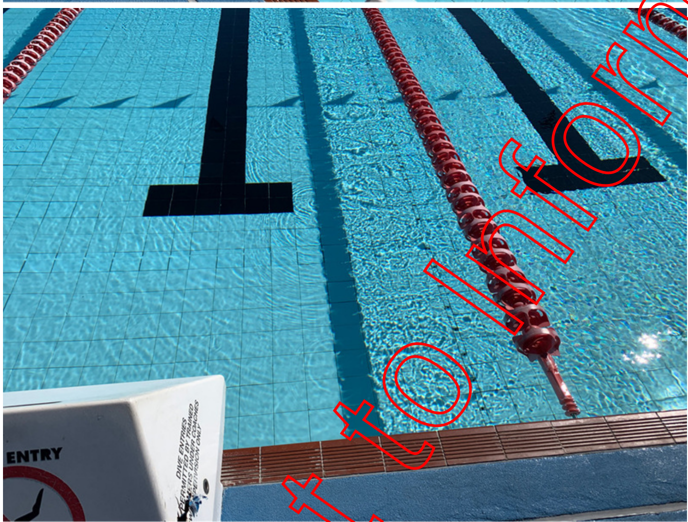
OUTDOOR 50M POOL

Element Name	Outdoor 50m Pool
General Description	The outdoor 50m pool is an 8-lane 50m fully tiled reinforced concrete lap pool. The pool is 20.5m wide, 1m deep at each end and grades to 2m deep in the centre. Wet decks are placed to the two long sides of the pool and raised hobs to the two ends. The pool is understood to be from the original construction of the site in the 1970's.
Pool Length (m)	50
Pool Width (m)	20.5
Pool Depth	1m deep at each end grading to 2m deep in the centre.
Finishes Description	Fully tiled with bathroom-style tiles
Circulation Description	Filtered water is delivered into the pool through a center return channel running along the length of the pool, fitted with small outlet holes in the top surface. Soiled water overflows wet deck gutters to the two long sides of the pool. It collects in underground pipework and flows to the drawoff tank adjacent the north-eastern corner of the pool. Balance lines appear to connect the pool to the balance tank through the wall to prevent the tank running dry.
Features Description	N/A
Element Condition	3 - Average
Remaining Life (Years)	15
Replacement Cost ($)	2000000

Element Photos



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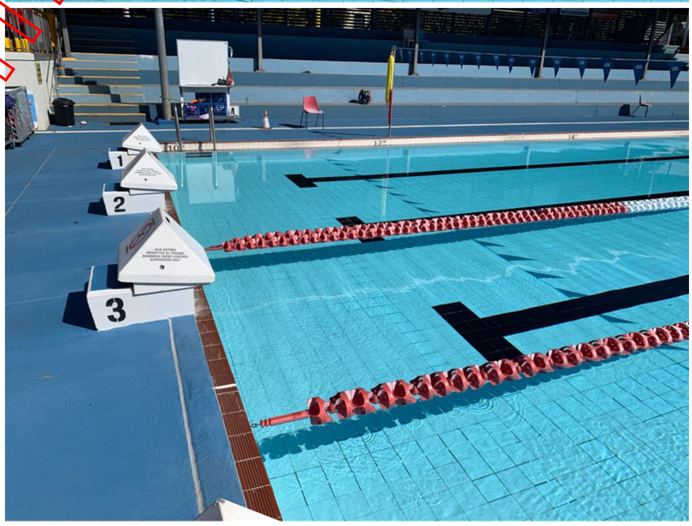
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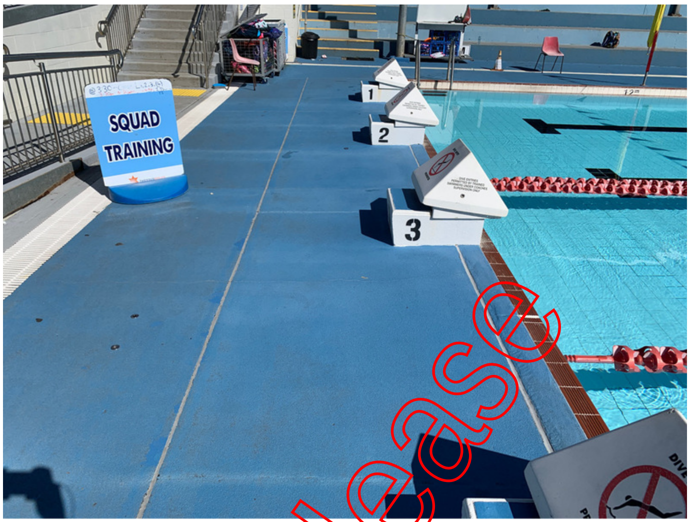
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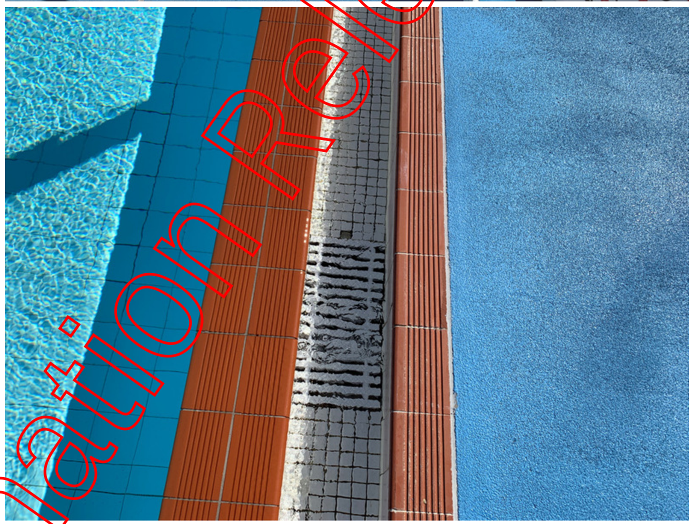

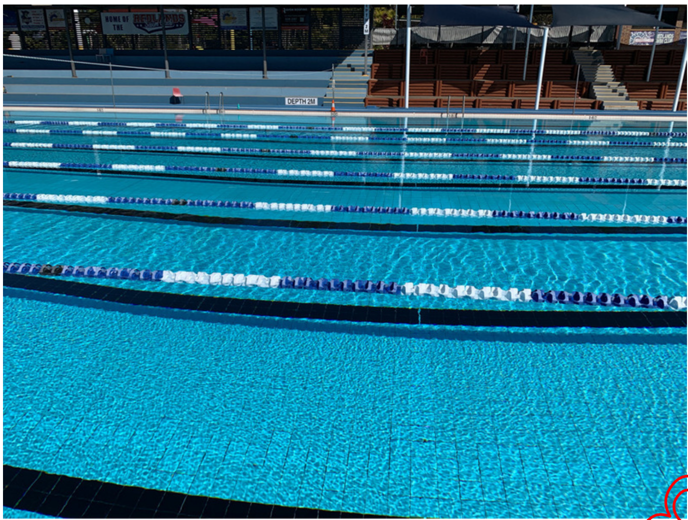

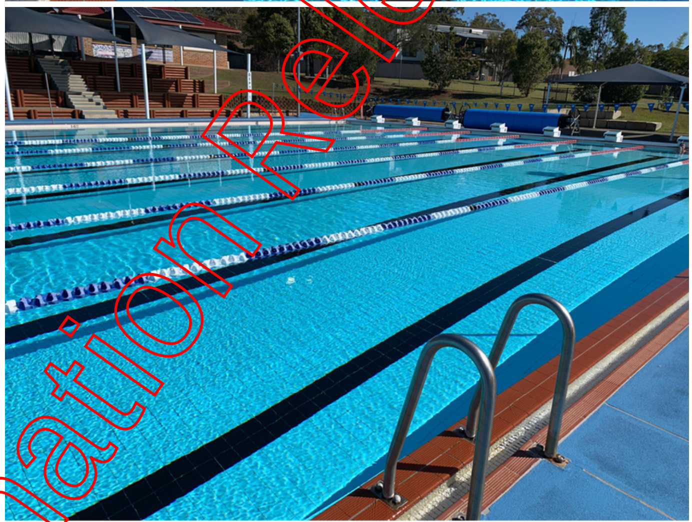

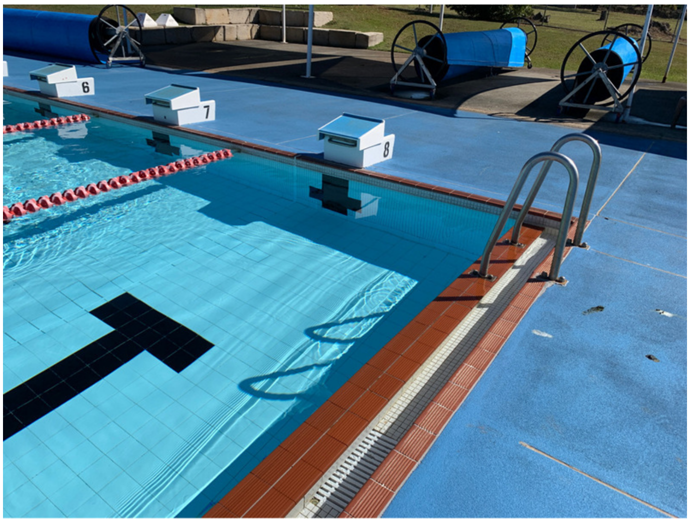
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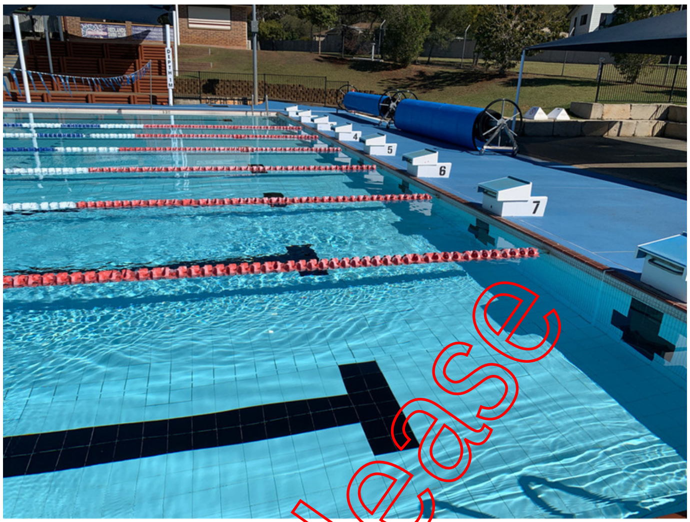
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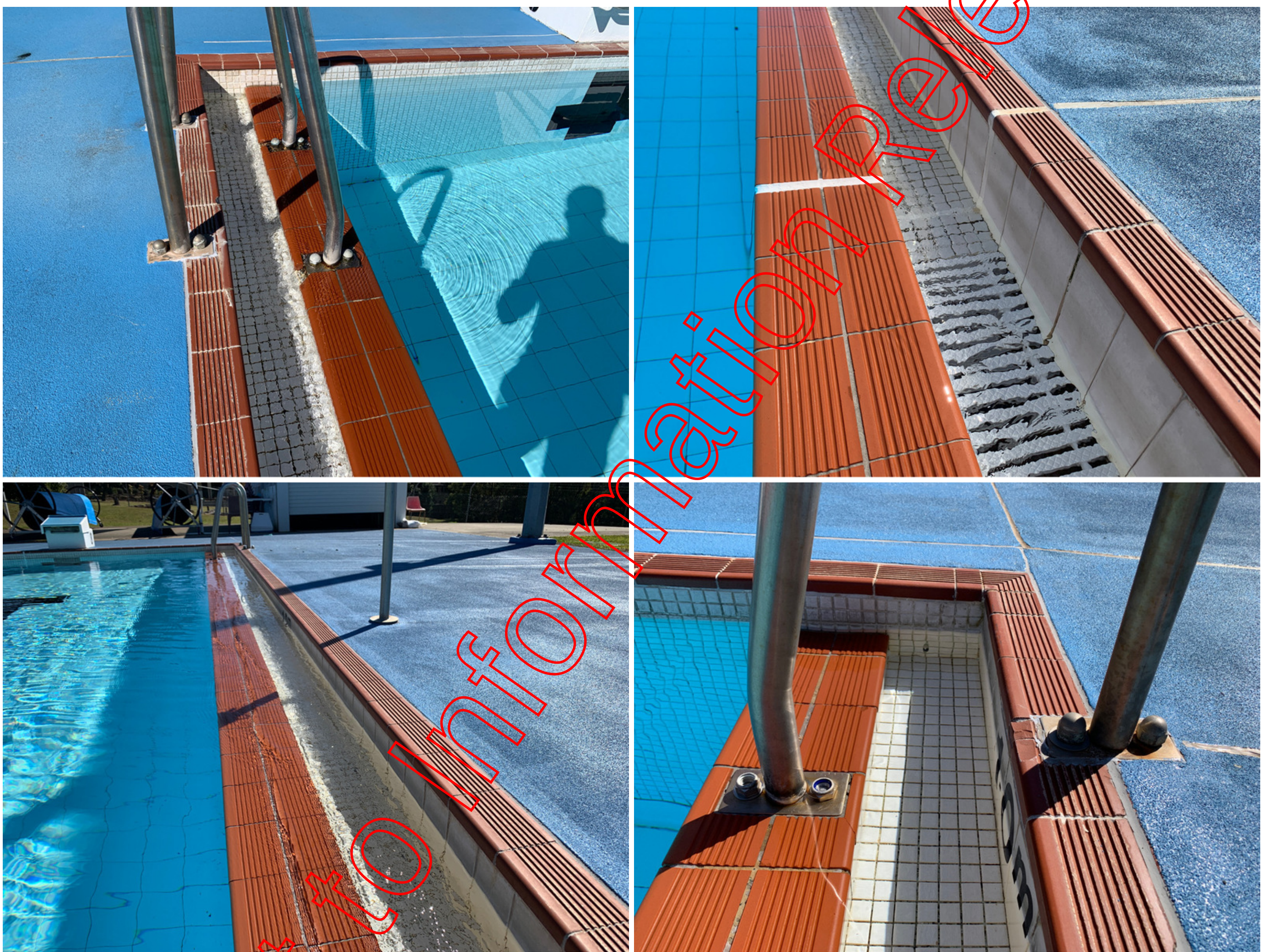
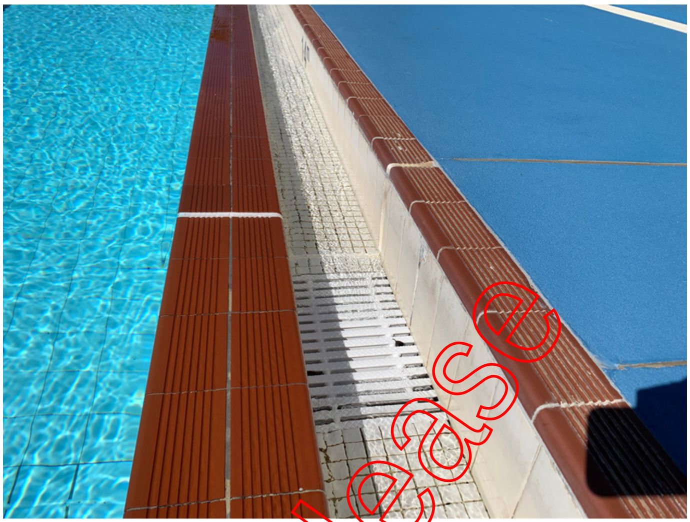
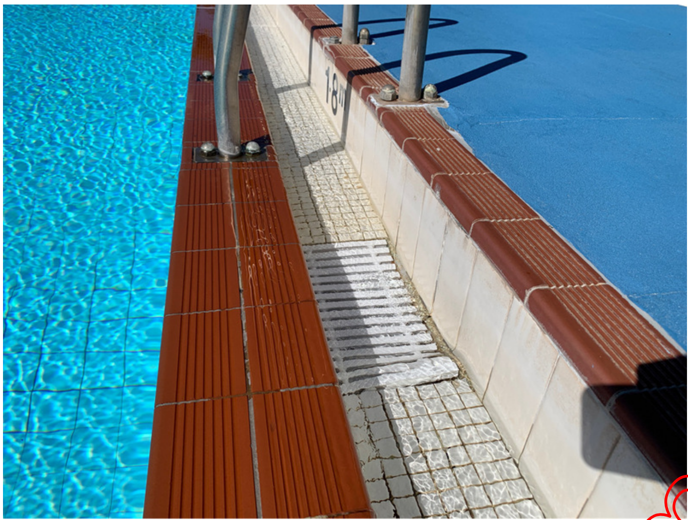
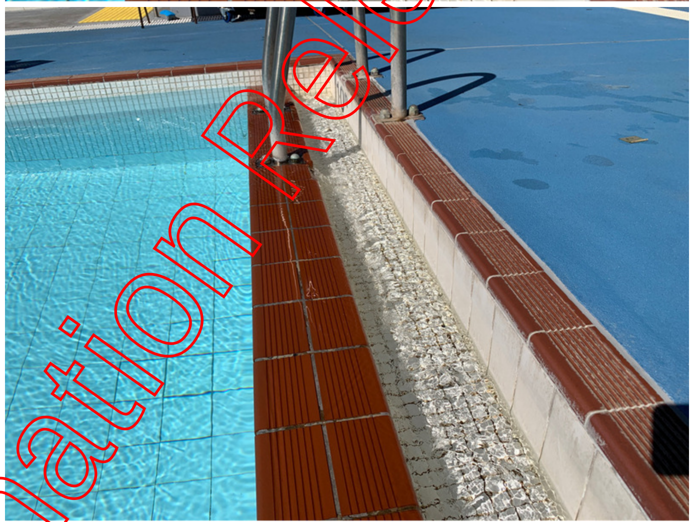
SITE OBSERVATIONS

SCUM GUTTER

Observation Description	Scum Gutter
Observation Details	The scum gutter is of an aged design. The system is running full, indicating the flow is at maximum capacity. Additionally, more water is flowing over the northern wet edge, with this side being out of level along the length indicating structural movement of the pool.
Recommendations	Consider an upgrade to the 50m pool
Critical Item?	No

Observation Photos



SITE OBSERVATIONS

DRAIN GRATING

Observation Description	Drain Grating
Observation Details	Wet deck grating covering the drain adjacent the pool is aging and broken in places
Recommendations	Replace the grating
Critical Item?	Yes

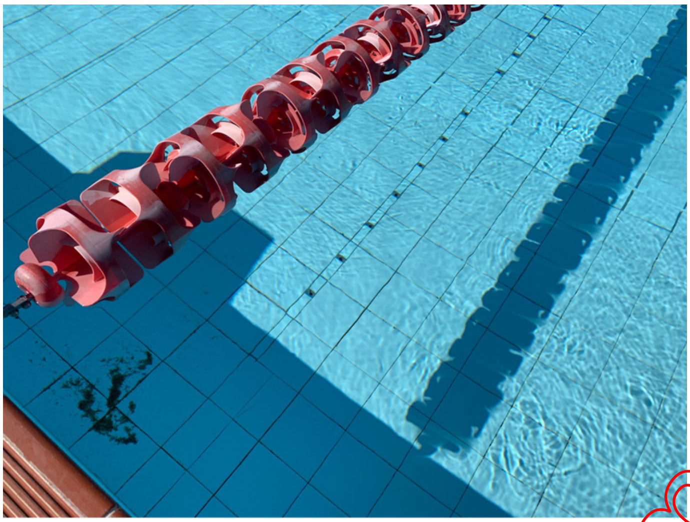
Observation Photos

SITE OBSERVATIONS

FILTERED WATER RETURN

Observation Description	Filtered Water Return
Observation Details	Filtered water is delivered to a central channel along the pool which is fitted with small holes in the top to deliver water. This type of return will have little impact on pool circulation beyond the outlets.
Recommendations	Undertake a dye circulation test in accordance with the model aquatic health code to visualise and confirm the circulation. Undertake rectification works as required.
Critical Item?	No

Observation Photos



SITE OBSERVATIONS

TILING

Observation Description	Tiling
Observation Details	The tiling provided in the pool is aging and not slip resistant. This is an issue for activities requiring grip on the pool floor
Recommendations	Replace the pool tiling
Critical Item?	No

Observation Photos

SITE OBSERVATIONS

DEPTH AND WARNING SIGNAGE

Observation Description	Depth and Warning Signage
Observation Details	Applicable to all the pools onsite, current signage does not comply with the Royal Lifesaving guidelines. Depth markers are inconsistent or not legible whilst advisory signage is not provided.
Recommendations	Engage Royal Lifesaving to undertake a signage audit at the facility including pools and plant rooms
Critical Item?	Yes

Observation Photos


DEEP WATER
1.0


SHALLOW WATER
1.0


SHALLOW WATER
0.25


LEARN TO SWIM, A GIFT FOR LIFE

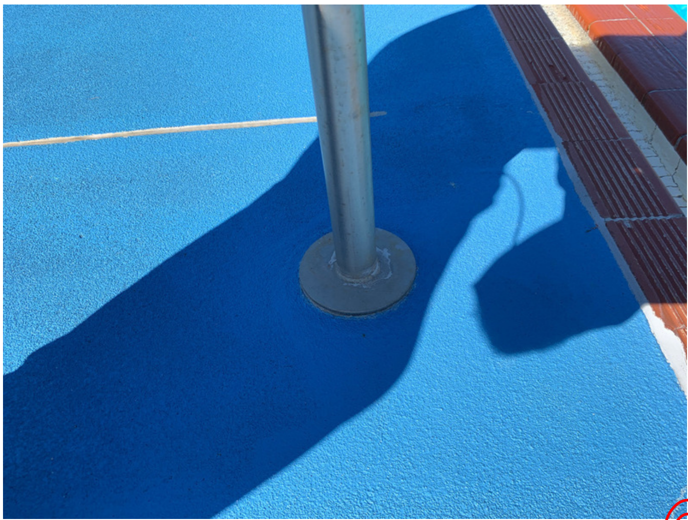
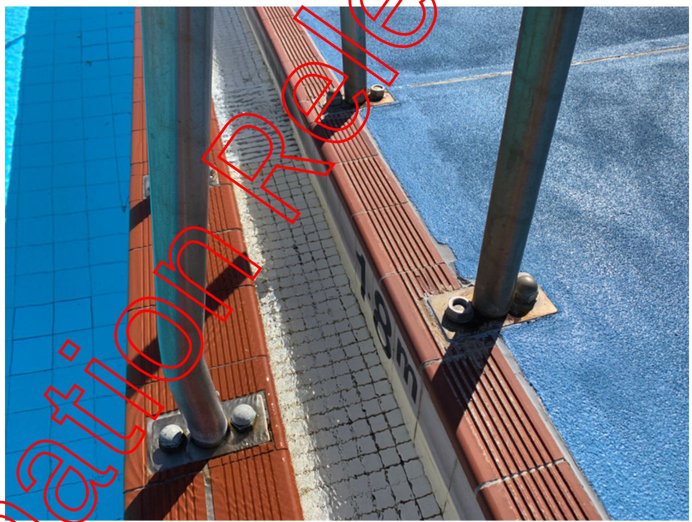
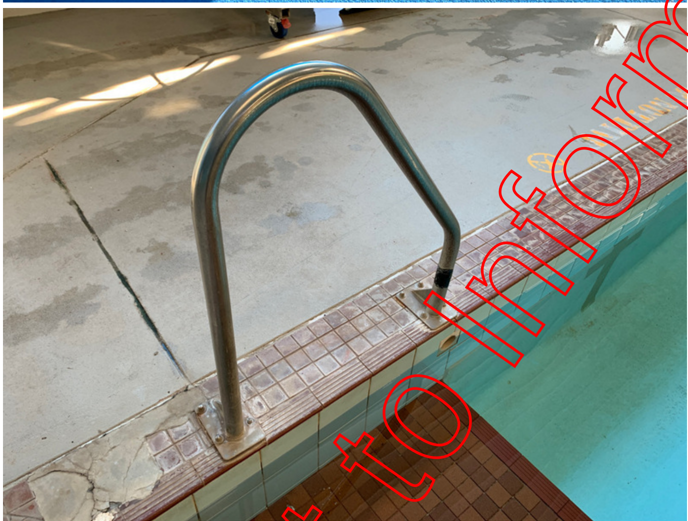

DO NOT DIVE

SITE OBSERVATIONS

EQUIPOTENTIAL BONDING

Observation Description	Equipotential bonding
Observation Details	Conductive items are present within arms reach of most pools, requiring equipotential bonding. This extends to all pools.
Recommendations	If not provided within the past 12 months, engage an electrician to undertake an earth bonding test of all items as required by AS3000
Critical Item?	Yes

Observation Photos

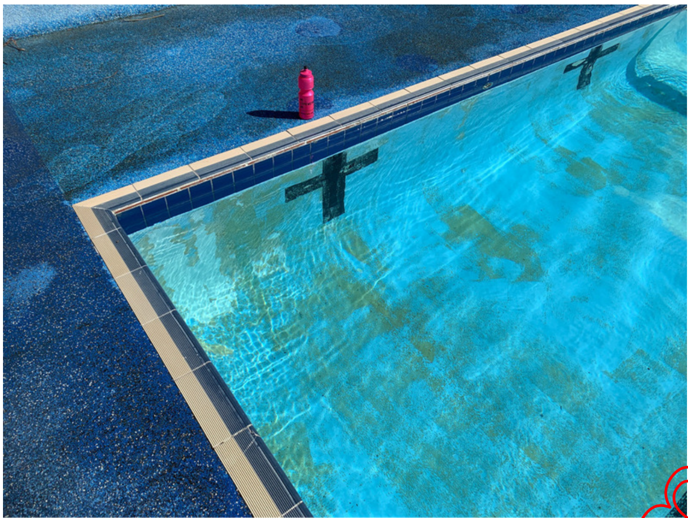
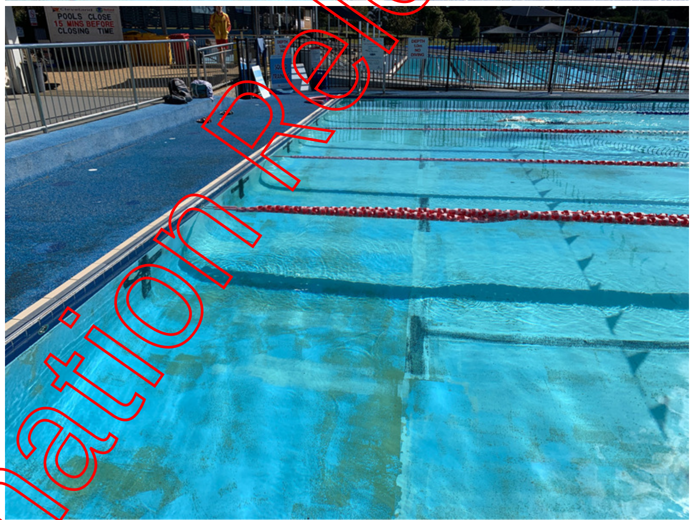
AQUATIC FACILITIES

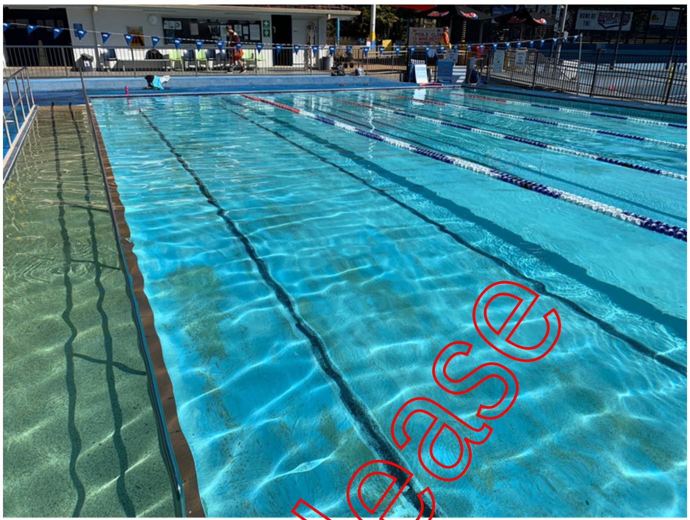
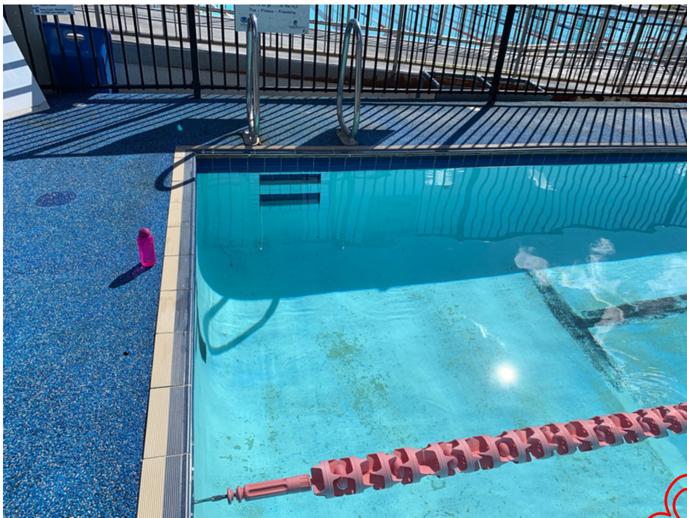
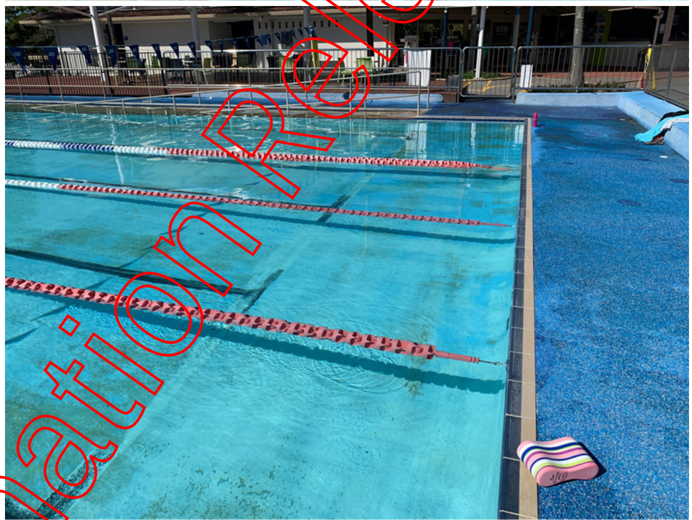
OUTDOOR 25M POOL

Element Name	Outdoor 25m Pool
General Description	The pool is a 25m long 6 lane lap pool, understood to be of concrete construction with a fiberglass internal lining. The pool is 1m deep at the shallow end, grading down to 1.2m at the deep end. An access ramp provides access to one side of the pool. The pool is a skimmer design pool. The pool is understood to have been constructed in the 1990's, replacing an existing wading pool.
Pool Length (m)	25
Pool Width (m)	13
Pool Depth	Pool grades from 1.0m deep at the shallow end to 1.2m deep at the deep end
Finishes Description	Pool is finished with a painted fibreglass liner, with coping tiles to the perimeter
Circulation Description	Filtered water is delivered into the pool through a series of wall return fittings along both sides of the pool. The returns are currently open pipes and not provided with fittings. Soiled water is drawn into 10 skimmer boxes located along the two long sides of the pool. Pipework joins these skimmer boxes back to the equipment room.
Features Description	N/A
Element Condition	4 - Poor
Remaining Life (Years)	5
Replacement Cost ($)	1250000

Element Photos





POOLS CLOSE
15 MINS BEFORE
CLOSING TIME

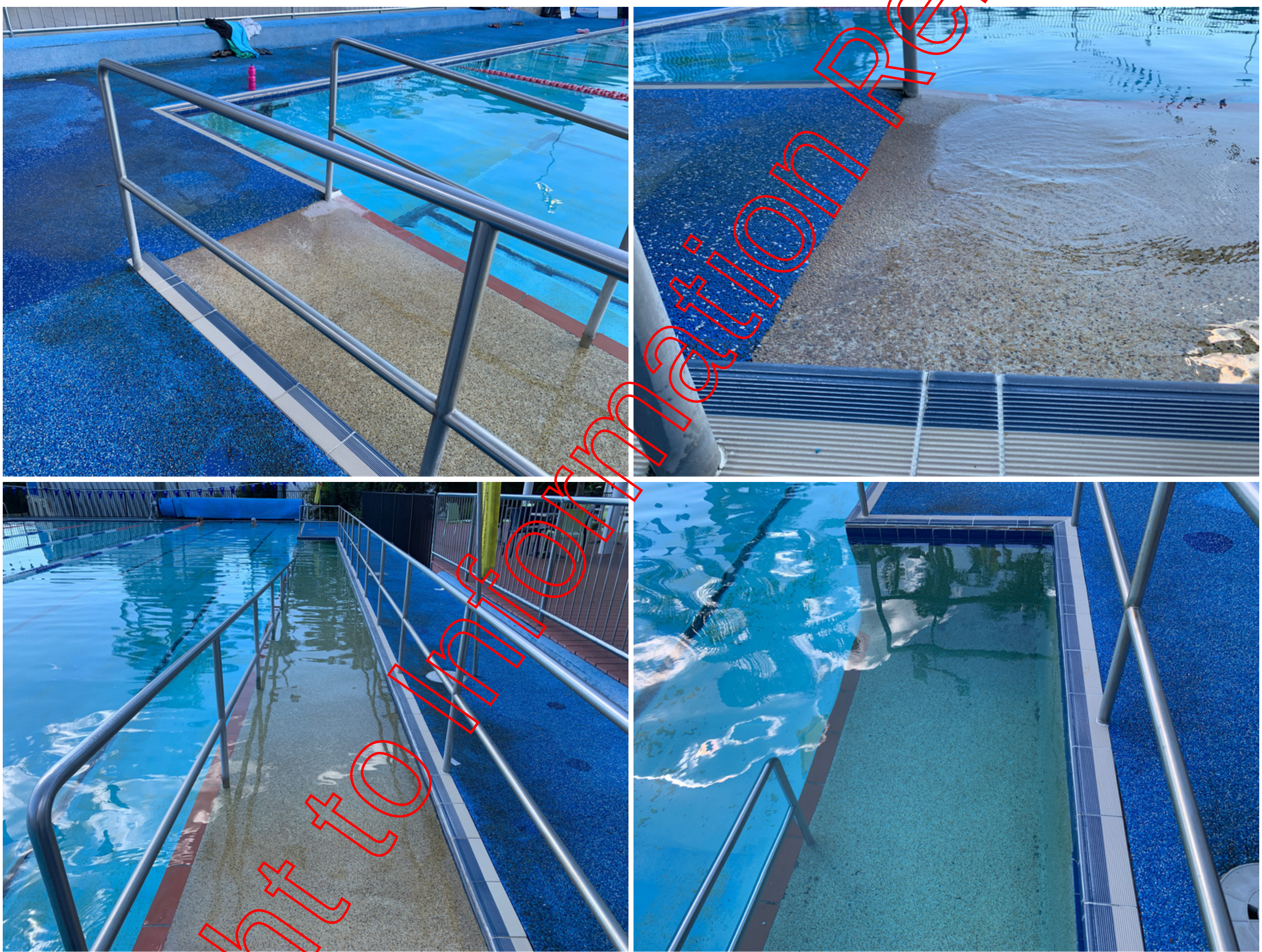





SITE OBSERVATIONS

RAMP COMPLIANCE

Observation Description	Ramp Compliance
Observation Details	The disabled access ramp is not compliant with AS1926.3: o No mid landing is provided o Only one handrail is provided, with the other handrail being non-compliant o The entry to the ramp is too steep o The ramp delivers too deep
Recommendations	Replace the ramp. In the interim, provide signage to inform patrons of the issues with the ramp.
Critical Item?	No

Observation Photos



SITE OBSERVATIONS

POOL FINISH

Observation Description	Pool Finish
Observation Details	The painted finish is in very poor condition with the underlying fibreglass liner appearing very worn in places.
Recommendations	Remove the fibreglass liner and refinish the pool
Critical Item?	No

Observation Photos



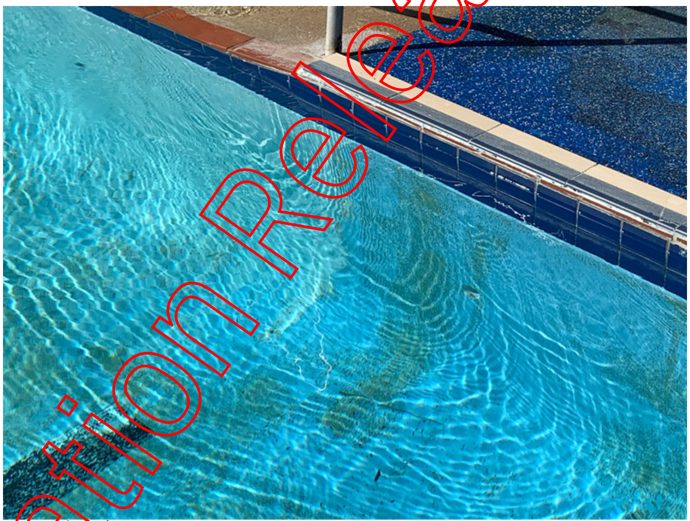



SITE OBSERVATIONS

CIRCULATION FITTINGS

Observation Description	Circulation Fittings
Observation Details	The marjority of circulation fittings are missing in the pool with just bare pipe showing
Recommendations	Provide eyeball and floor rerun fittings to all bare pipes
Critical Item?	Yes

Observation Photos

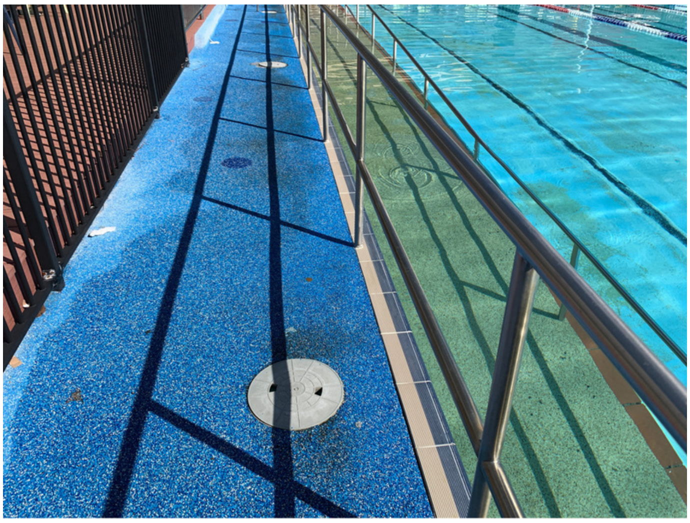



SITE OBSERVATIONS

POOL CIRCULATION

Observation Description	Pool Circulation
Observation Details	Circulation through the pool is likely poor due to the low flow and the poor number of fittings
Recommendations	As with the 50m pool, provide a circulation dye test
Critical Item?	No

Observation Photos



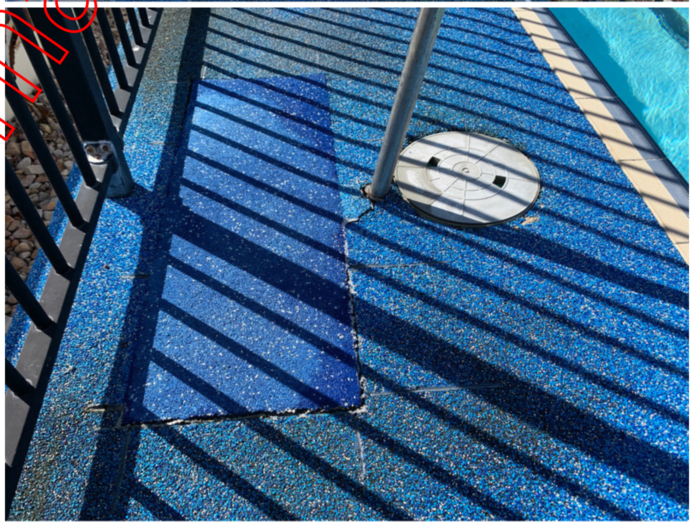
SITE OBSERVATIONS

CONCOURSE CIRCULATION AND CONDITION

Observation Description	Concourse Circulation and Condition
Observation Details	Concourse circulation space is very tight, especially with instructions from blankets. Additionally the rubberised coating is in poor conditions
Recommendations	Review circulation around the pool and look to improve. Replace the rubberised coating.
Critical Item?	Yes

Observation Photos



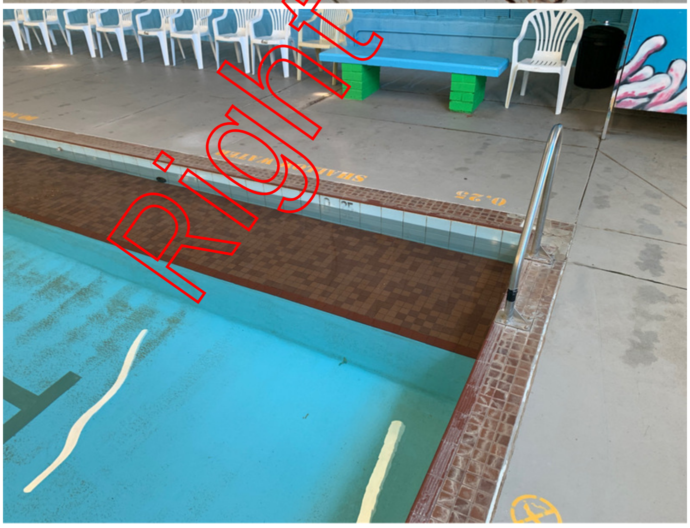


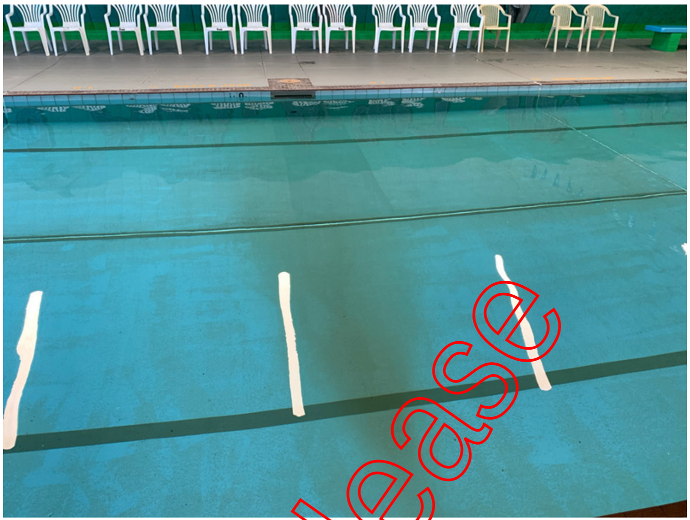

AQUATIC FACILITIES

INDOOR LTS POOL

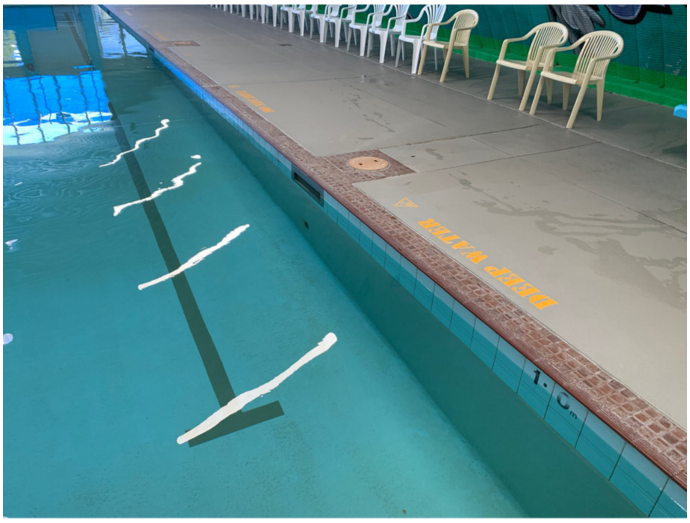
Element Name	Indoor LTS Pool
General Description	The pool is a 20m long x 6.8m wide (6m main body with 800mm wide bench) reinforced concrete pool fitted with a fiberglass internal liner. The pool is 1m deep to the full extent with a 250mm deep bench along one side. The pool is a skimmer design pool, understood to be from the original construction in the 1970's.
Pool Length (m)	20
Pool Width (m)	6.8
Pool Depth	1m to the full extent with a 250mm dep x 800mm wide bench along one wall
Finishes Description	Coping tiles with a painted fibreglass internal lines
Circulation Description	Filtered water is delivered into the pool through six wall return fittings generally installed along the bench but with one fitting installed in the corner of the pool. Soiled water is drawn into three skimmer boxes located along the long side of the pool opposite the bench. Pipework joins these skimmer boxes back to the equipment room.
Features Description	N/A
Element Condition	4 - Poor
Remaining Life (Years)	5
Replacement Cost ($)	750000

Element Photos

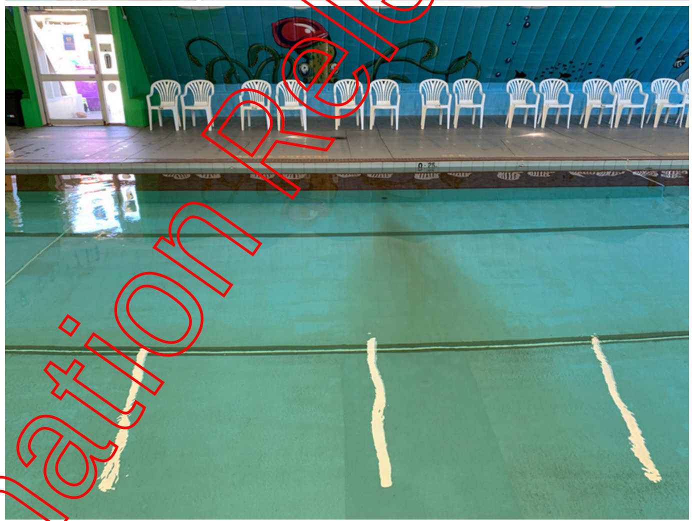



SHALLOW WATER


DEEP WATER


DO NOT DIVE

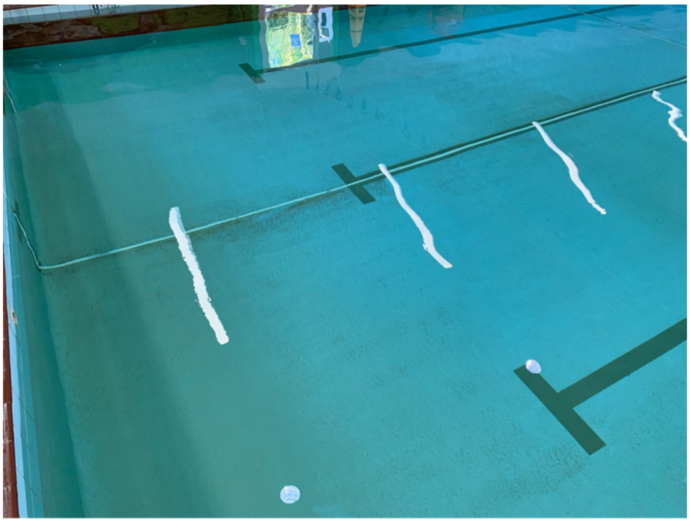


SITE OBSERVATIONS

FINISHES CONDITION

Observation Description	Finishes Condition
Observation Details	The finishes are in poor condition overall. The painted finish has failed with fibreglass visible through. Grout on the bench is generally missing whilst coping tiles are stained.
Recommendations	Replace the pool finishes
Critical Item?	No

Observation Photos

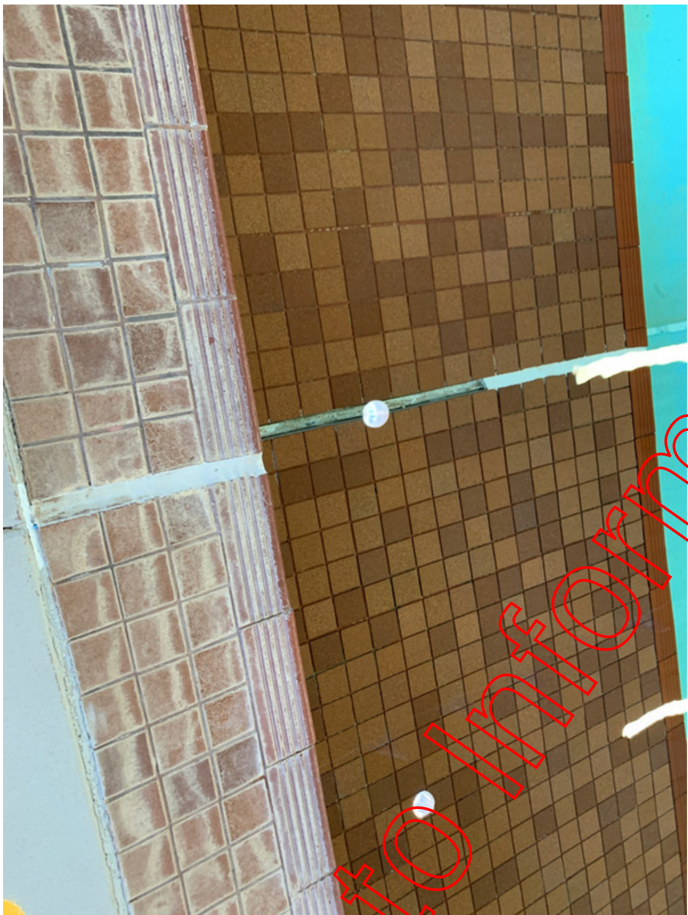


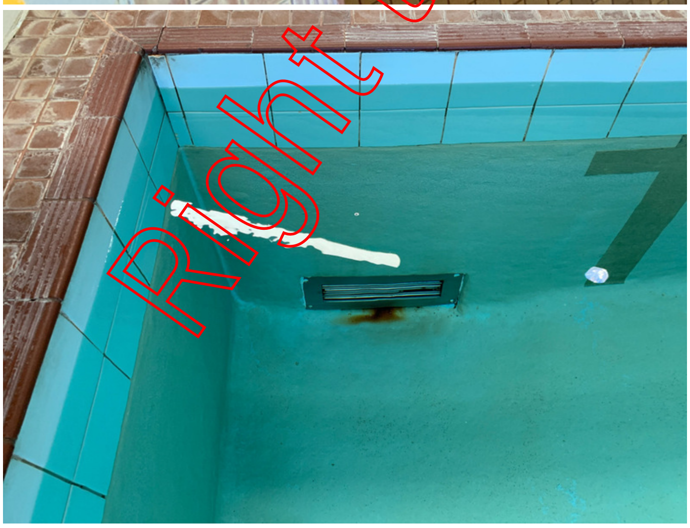
SITE OBSERVATIONS

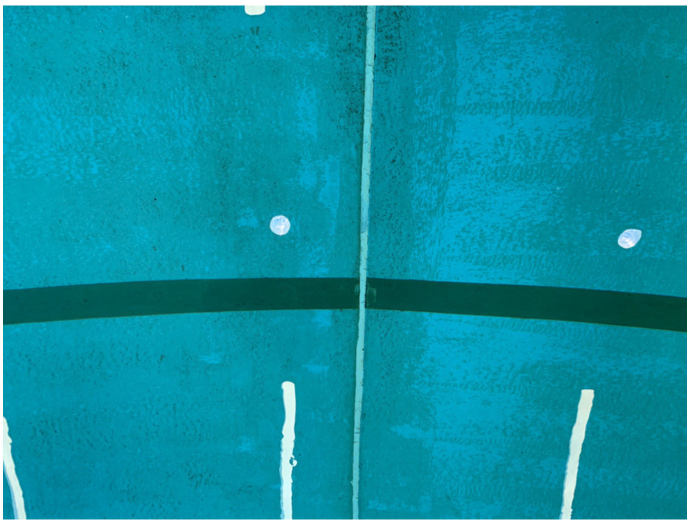
STRUCTURAL CONDITION

Observation Description	Structural Condition
Observation Details	Concerns are raised regarding the structural condition of the pool. The pool is reported to leak by the operators, with the water level dropping noticeably on shutdown. Damage is observed to one corner of the pool whilst rust is observed from the end of the bench and the floor drain. Silicon in joints is in bad condition.
Recommendations	As a short term approach, replace silicon and investigate leaks. The presences of the fibreglass liner makes inspection of the concrete substructure difficult. In the long term, allow to replace the pool.
Critical Item?	No

Observation Photos







SITE OBSERVATIONS

ANCHORS

Observation Description	Anchors
Observation Details	Lane rope anchors protrude from the wall which create a finger and toe entrapment risk
Recommendations	Replace with flush anchors
Critical Item?	Yes

Observation Photos

SITE OBSERVATIONS

SKIMMER SUCTION FITTINGS

Observation Description	Skimmer Suction Fittings
Observation Details	Each skimmer appears to be connected to a suction fitting in the wall which is not fitted with an AS1923 compliant cover. This creates a suction entrapment risk and requires rectification urgently.
Recommendations	Block off fittings or provide compliant fittings.
Critical Item?	Yes

Observation Photos

AQUATIC FACILITIES

OUTDOOR PLAY POOL

Element Name	Outdoor Play Pool
General Description	The pool is a freeform play pool, approximately 25m long x 20m wide overall. The pool is varying depth throughout and is fitted with a waterslide and various water toys. The pool is a skimmer design pool, understood to be constructed in the early 2000's.
Pool Length (m)	25
Pool Width (m)	20
Pool Depth	Beach entry to 1.8m
Finishes Description	Pebblecrete to the full interior extent
Circulation Description	Filtered water is delivered into the pool through three rows of floor returns installed across the pool. Soiled water is drawn into a series of skimmer boxes placed around the walls of the pool. Pipework joins these skimmer boxes back to the equipment room. Wall suctions are present in the pool. Whilst as-constructed documentation is not available and the pipework pathways could not be confirmed, it's assumed that some of these wall suctions connect to the skimmers as relief lines whilst others connect to the feature suction pump.
Features Description	Spray features are installed in the shallow regions of the pool whilst a fibreglass slide is installed in the deep area
Element Condition	3 - Average
Remaining Life (Years)	10
Replacement Cost ($)	1000000
Element Photos	












SITE OBSERVATIONS

WATERSLIDE START

Observation Description	Waterslide Start
Observation Details	A significant amount of rust is still present in the stairs leading to the waterslide start. This rust has increased in magnitude since the previous inspection.
Recommendations	Repair the rust as a priority
Critical Item?	Yes

Observation Photos





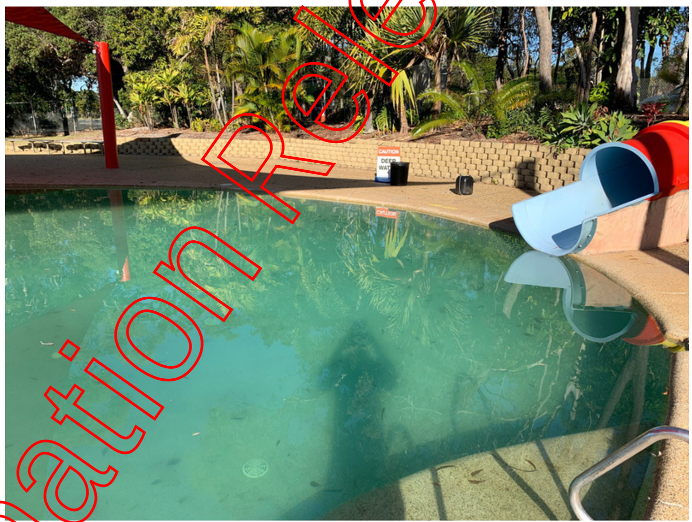


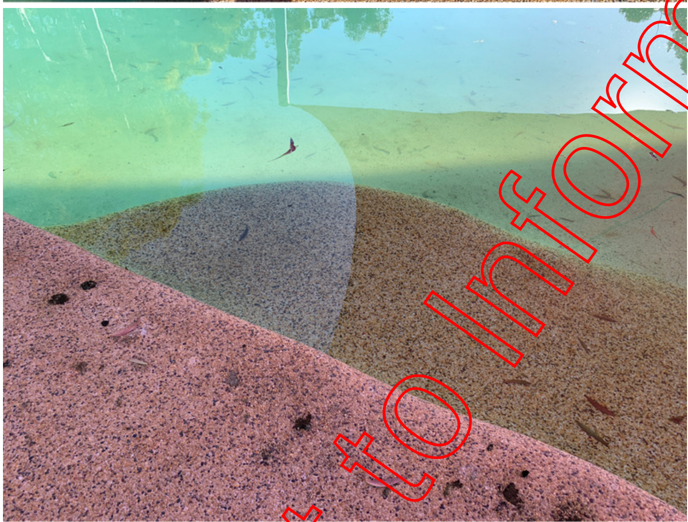
SITE OBSERVATIONS

POOL ACCESS

Observation Description	Pool Access
Observation Details	No compliant access point is provided in the deep end. A fibreglass step is present onto a swimout, however access does not continue to the flood of the pool nor are edge delineators provided to any steps or swimouts in the pool.
Recommendations	Add compliant ladders. Add edge delineation markers to all underwater edges.
Critical Item?	Yes

Observation Photos





SITE OBSERVATIONS

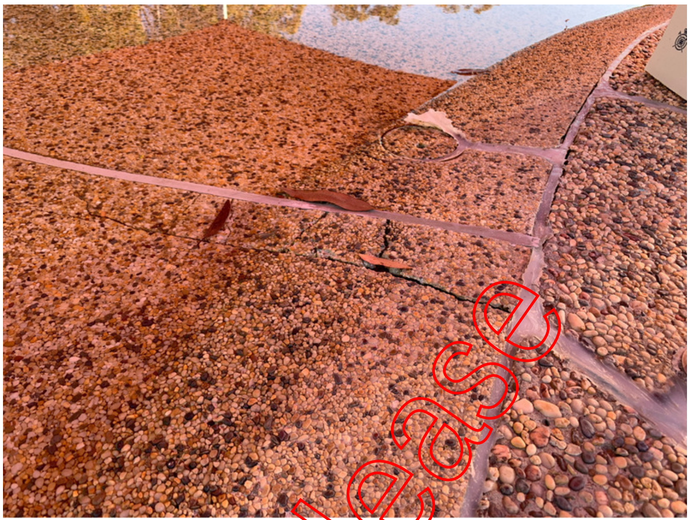
COPING FINISHES CONDITION

Observation Description	Coping Finishes Condition
Observation Details	The coping finishes condition is poor, with notable cracking observed in the finishes. In some areas sections of the finish are missing or delaminated.
Recommendations	Remove all finishes and inspect the sub grade for condition. Provide new finishes. In the interim, remove any loose areas and make good.
Critical Item?	Yes

Observation Photos

Aquatic One
19/14 Ashtan Place
Banyo, Qld 4014


DO NOT DIVE



SITE OBSERVATIONS

POOL SILICON

Observation Description	Pool Silicon
Observation Details	Pool silicon requires replacement
Recommendations	Leak test and replace.
Critical Item?	No

Observation Photos

SITE OBSERVATIONS

CONCOURSE MOVEMENT

Observation Description	Concourse Movement
Observation Details	The concourse adjacent the small waterslide appears to have moved away from the pool approximately 10mm, indicating ground subsidence.
Recommendations	Reseal the joint and monitor for further movement or structural degradation of the concourse
Critical Item?	No

Observation Photos

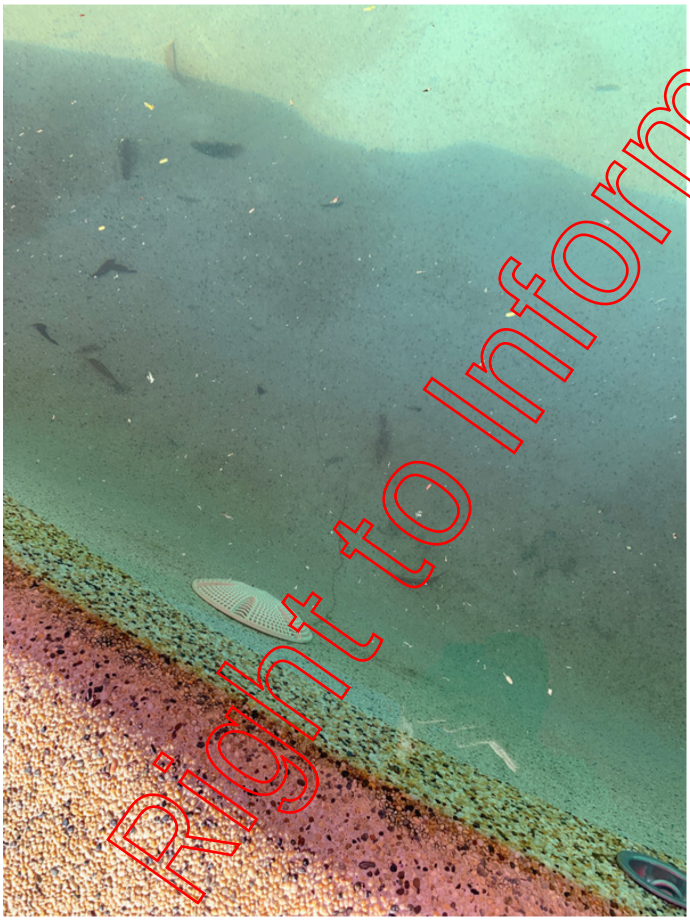
SITE OBSERVATIONS

STRUCTURE CRACK

Observation Description	Structure Crack
Observation Details	A structural crack is observed running across the deep end of the pool
Recommendations	Inspect the crack for leaks and seal the crack
Critical Item?	Yes

Observation Photos






Aquatic One
19/14 Ashtan Place
Banyo, Qld 4014

SITE OBSERVATIONS

SUCTION FITTINGS

Observation Description	Suction Fittings
Observation Details	Old suction fittings are present in the wall of the pool.
Recommendations	Remove the fittings and replace with new AS1926.3 compliant items
Critical Item?	Yes

Observation Photos


SITE OBSERVATIONS

WATERSLIDE SUPPORT

Observation Description	Waterslide Support
Observation Details	One of the legs of the waterslide is poorly supported half on a brick
Recommendations	Rectify the support
Critical Item?	Yes

Observation Photos

SITE OBSERVATIONS

WATER TOY CONDITION

Observation Description	Water Toy Condition
Observation Details	The water play toys are aging
Recommendations	Refurbish the Waterplay toys
Critical Item?	No

Observation Photos




AQUATIC FACILITIES

OUTDOOR RIVER POOL

Element Name	Outdoor River Pool
General Description	The pool is an ellipse-shaped river pool, approximately 17m long and 15m wide. The pool is of reinforced construction and is a constant depth to the perimeter of the ~2.4m wide channel. The main feature for the pool is the channel flow system, where large pumps draw water from the side of the pool and inject into floor jets to circulate water around the channel. The pool is a semi-skimmer design pool, understood to be constructed in the early 2000's.
Pool Length (m)	17
Pool Width (m)	15
Pool Depth	Approx 1200
Finishes Description	Pebblecrete rollover hob to the perimeter of the pool with painted finish throughout
Circulation Description	A large grated overflow sump is located in the wall of the pool adjacent the stairs. Water overflows into this sump. A large single suction fitting in this sump connects through pipework up to the plant room. The pipe splits at the plant room into two suction lines which appear in the pump well. The two main river circulation pumps connect to these pipes then tee together into a single line above these pipes before flowing back out to the pool. The pipework splits at the pool into series of river flow jets located in the floor of the pool. The filtration pumps draws water from the river pump outlets, and pumps through the filtration system in the plant room. The return water is then delivered back into the river pump outlet line downstream of a check valve. It appears as though previously this system was directly connected to the pool, as cut-off pipework is present nearby in the plant room.
Features Description	Motive jets located in the walls provide the river current.
Element Condition	4 - Poor
Remaining Life (Years)	5
Replacement Cost ($)	500000
Element Photos	




SITE OBSERVATIONS

STRUCTURE CRACKS

Observation Description	Structure cracks
Observation Details	Numerous cracks are present in the structure, with many repairs observed. Whilst the majority of the cracks appear to be in the coping, some of the cracks continue down through the pool structure itself.
Recommendations	Consider replacement of the pool
Critical Item?	No

Observation Photos

SITE OBSERVATIONS

FINISHES CONDITION

Observation Description	Finishes condition
Observation Details	The painted finish has failed
Recommendations	Replace the painted finish
Critical Item?	No

Observation Photos

SITE OBSERVATIONS

SURFACE SKIMMING

Observation Description	Surface Skimming
Observation Details	The outlet chamber is flooded at the time of the inspection. No surface skimming takes place. A large amount of leaf matter remains suspended in the pool
Recommendations	Consider replacement of the pool
Critical Item?	No

Observation Photos




EQUIPMENT ROOMS

NORTHERN EQUIPMENT ROOM

Room Identifier	Northern Equipment Room
Room Description	Original equipment room onsite containing the filtration, circulation and heating equipment for the 50m pool

Equipment Room Photos





MUST BE WORN IN THIS AREA
HANDLING CHEMICALS


HYDROCHLORIC ACID
1789
2R
CORROSIVE
8
HAZCHEM
SAFETY DATA SHEETS (SDS)
HAZARDOUS MATERIALS


2R
CORROSIVE
8
HYDROCHLORIC ACID
5L
x4







DANGER
KEEP OUT
AUTHORISED PERSONNEL ONLY
CALCIUM HYPOCHLORITE
2880
1W


ISOCYANURIC AC

SITE OBSERVATIONS

ELECTRICAL INSTALLATION

Observation Description	Electrical Installation
Observation Details	Issues are present with the electrical installation such as boards in poor condition, broken latches etc. This produces a notable safety concern.
Recommendations	Engage an electrician to undertake a condition and compliance audit on the electrical installation as a priority. It is recommended to extend this audit to the entire facility, covering all three plant rooms and any extraneous electrical works.
Critical Item?	Yes

Observation Photos




SITE OBSERVATIONS

CHLORINE STORAGE

Observation Description	Chlorine Storage
Observation Details	The bulk chlorine storage produces several non-conformances including: o No truck unloading bund o Levels not marked on tank o No tank overflow o Bund in poor condition and unlikely to seal o Tank vents to room o Chlorine pump mounted on degraded shelf
Recommendations	Replace the entire chlorine storage facility
Critical Item?	Yes

Observation Photos

Aquatic One
19/14 Ashtan Place
Banyo, Qld 4014


ROBERTSON TRANSPORT
(07) 3888 6222
DANGER - CONFINED SPACE
TANK
C
SODIUM
HYPOCHLORITE
1791
2X
CORROSIVE
8


TAN
C

SITE OBSERVATIONS

PIPEWORK SIZE

Observation Description	Pipework Size
Observation Details	The 50m pool pipework reduces in size too soon, increasing the pressure loss as discussed in the audit report.
Recommendations	Upsize the offending pipework
Critical Item?	No

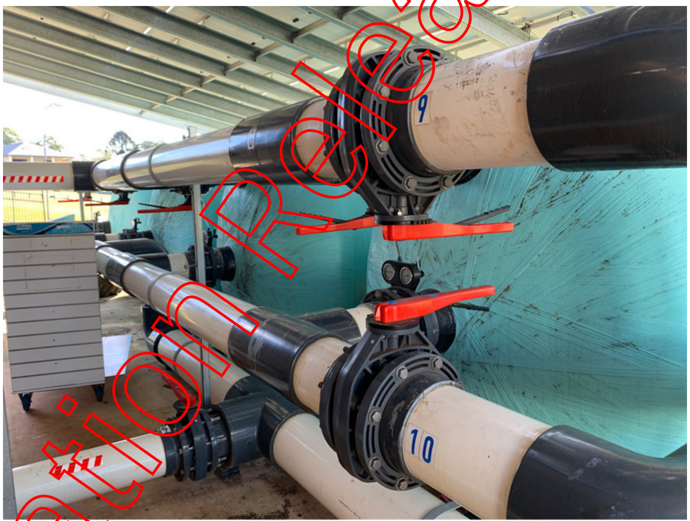
Observation Photos

SITE OBSERVATIONS

LABELLING

Observation Description	Labelling
Observation Details	Pipework and equipment labelling is generally poor
Recommendations	Label all pipework and chemical injectors, as well as all equipment
Critical Item?	No

Observation Photos

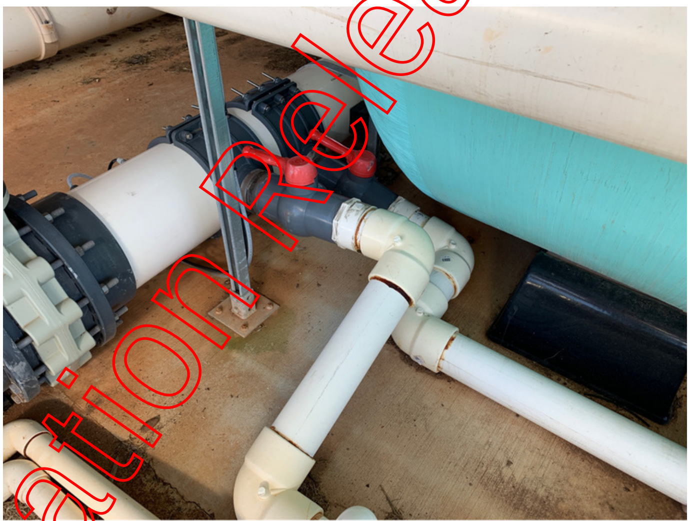
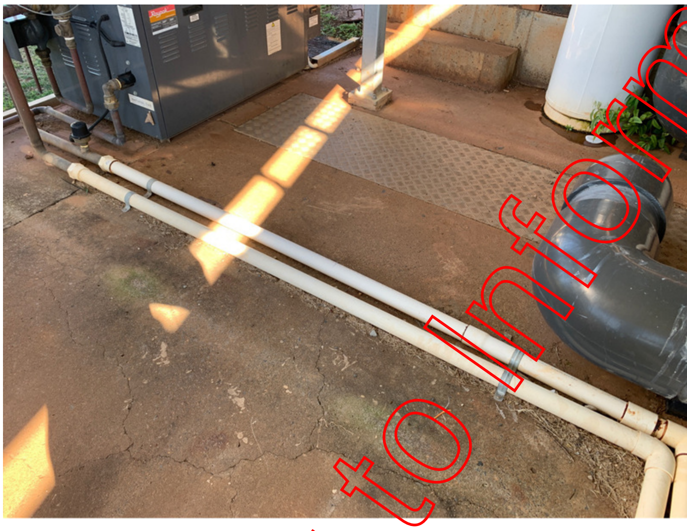


SITE OBSERVATIONS

HEATER PIPEWORK

Observation Description	Heater Pipework
Observation Details	Heater Pipework is poorly installed, with practically no supports and pipe run across the ground instead of overhead creating a trip hazard.
Recommendations	Rerun all heater pipework and secure properly
Critical Item?	No

Observation Photos


SITE OBSERVATIONS

CHEMICAL STORAGE

Observation Description	Chemical Storage
Observation Details	The calcium hypochlorite storage room is not well laid out, with failing shelves, insufficient signage and what appears to be spilled chemicals.
Recommendations	Upgrade chemical storage facilities including shelving, signage, access ways etc.
Critical Item?	Yes

Observation Photos






EQUIPMENT ROOMS

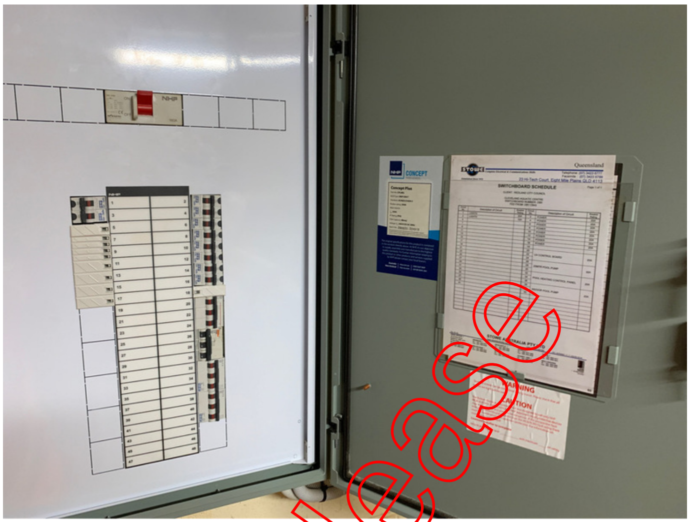
EASTERN EQUIPMENT ROOM

Room Identifier	Eastern Equipment Room
Room Description	Combination indoor/outdoor equipment area containing the filtration, sanitation, circulation and heating equipment for the 25m and LTS pools

Equipment Room Photos


ANALOX
BOC
CELLAGUARD
CARBON DIOXIDE ALARM REPEATER
CALIBRATION
BY
DATE
DUE
GOOD
ALARM 1
ALARM 2
FAULT
MODE


CAUTION
DO NOT ENTER ROOM IF CO_2 ALARM IS ACTIVATED
SITE SAFETY
PLANT ROOM
NO UNAUTHORISED ACCESS
KEEP LOCKED SHUT
PPE MUST BE WORN IN THIS ARE
WHEN HANDLING CHEMICALS




NHP


POOL HEATING CONTROL PANEL
GULFSTREAM
SOLAR CONTROLLER
COMPUTERMATIC

SITE OBSERVATIONS

GENERAL ACCESS AND ROOM CONDITION

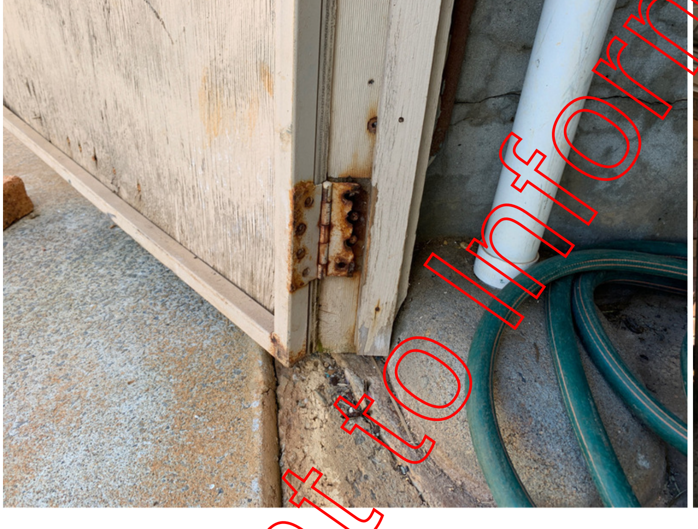
Observation Description	General Access and Room Condition
Observation Details	General access around the equipment room is poor. External areas require walking on grass and squeezing between areas to reach filter valves whilst internal access is not in compliance with AS1657. Additionally the room is in poor condition with head strike risks from old heater flues, trip hazards on entry, failing door hinges and failing wall panels.
Recommendations	Demolish the existing equipment room and provide a new room that is correctly laid out, with good chemical storage and safe design
Critical Item?	Yes

Observation Photos









ARDITUBE


CERAMIC WALL TILES

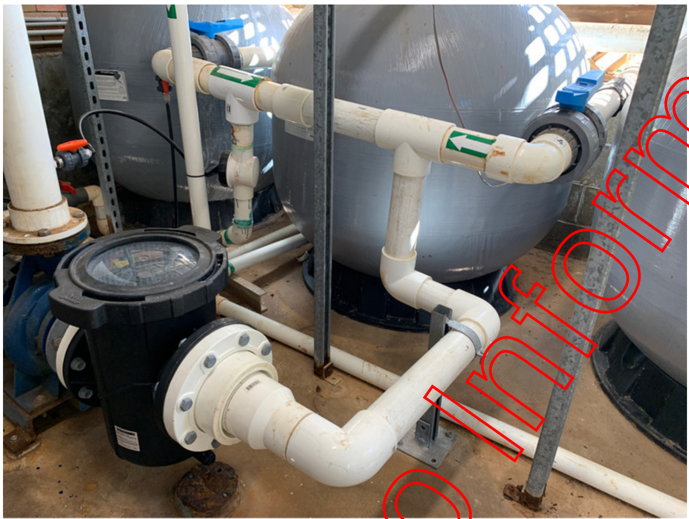
SITE OBSERVATIONS

PIPEWORK SUPPORTS

Observation Description	Pipework Supports
Observation Details	Pipework is poorly run and poorly supported. Leaks are observed in several locations.
Recommendations	Reroute pipework that is not straight and true, replace poor condition valves and provide pipe supports to Australian Standards so that no item of equipment is supporting pipework. Seal all leaks
Critical Item?	No

Observation Photos


FILTERED WATER



SITE OBSERVATIONS

PIPE AND EQUIPMENT LABELLING

Observation Description	Pipe and equipment labelling
Observation Details	Labelling is generally poor.
Recommendations	Provide labelling to each item of equipment and each service
Critical Item?	No

Observation Photos

SITE OBSERVATIONS

CHLORINE DELIVERY AND STORAGE

Observation Description	Chlorine Delivery and Storage
Observation Details	The chlorine system presents several non-conformances: o No truck bund is provided, with the truck parking in a public space o Trip and slip hazards are present in the filling area o The condition of the bund room is very poor, with the bund unlikely to seal. o The tank vents to the room o No overflow is provided o The tank is in poor condition and at end of life o Levels are not marked on the tank
Recommendations	Replace the entire chlorine storage installation
Critical Item?	Yes

Observation Photos


HAZCHEM
SODIUM
HYPOCHLORITE
UN No.
1791
HAZCHEM
2X
CORROSIVE
8
DANGER
SDS
SHOWER
WASH


SODIUM
HYPOCHLORITE
1791
2X
SDS

SITE OBSERVATIONS

ELECTRICAL WIRING

Observation Description	Electrical Wiring
Observation Details	Wiring is poorly run and labelled in many locations, with no local isolators at equipment.
Recommendations	Engage an electrician to undertake a detailed safety and compliance audit on the electrical system
Critical Item?	Yes

Observation Photos

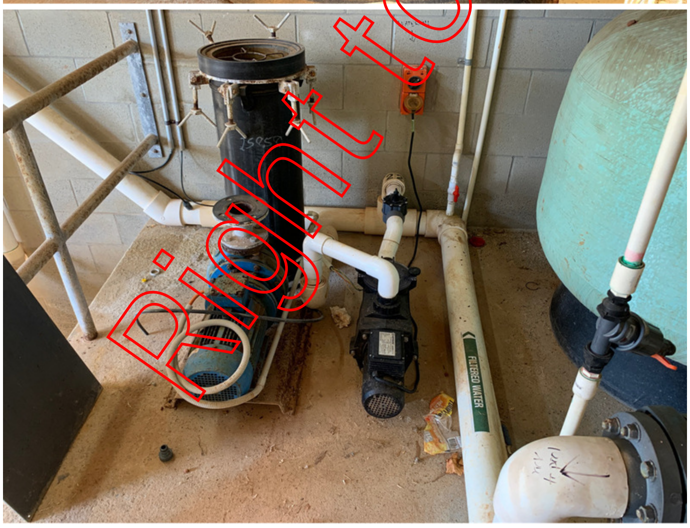
EQUIPMENT ROOMS

WESTERN EQUIPMENT ROOM

Room Identifier	Western Equipment Room
Room Description	Elevated equipment room containing the filtration, sanitation, circulation and heating equipment for the leisure and river pools

Equipment Room Photos




HYDROCHLORIC
ACID
1789
2R
CORROSIVE
8


HYDROCHLORIC
ACID
1789
2R
CORROSIVE
8

SITE OBSERVATIONS

EQUIPMENT ROOM ACCESS

Observation Description	Equipment Room Access
Observation Details	Access into the equipment room is poor; o There’s a hard-to-see step up into the plant room which presents a large trip hazard o Access around the pumps is highly non-compliant and dangerous
Recommendations	Relocate the pumps to an alternative location and rectify the trip hazards.
Critical Item?	Yes

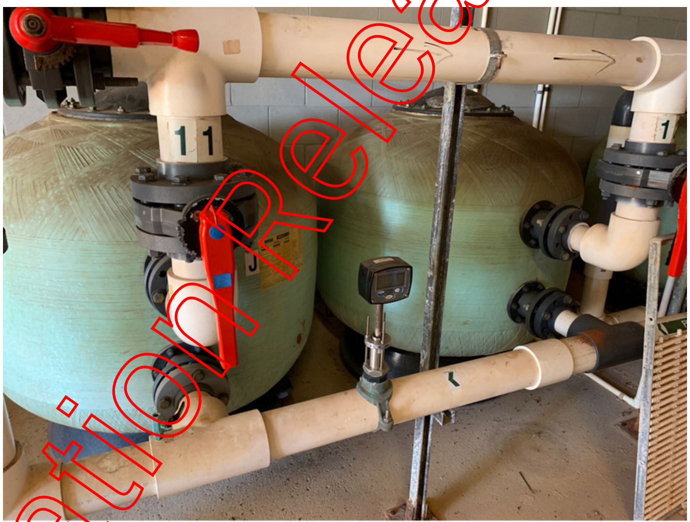
Observation Photos

SITE OBSERVATIONS

FLOW METER LOCATIONS

Observation Description	Flow Meter Locations
Observation Details	Both flow meters are installed between filters 2 and 3, not giving full readings
Recommendations	Relocate the flow meters
Critical Item?	No

Observation Photos



SITE OBSERVATIONS

PIPE SUPPORTS

Observation Description	Pipe Supports
Observation Details	Pipe supports are generally inadequate, with long lengths of pipe supported on filters or pumps and several supports just being an unsecured shelf under a pipe. Additionally supports are corroded.
Recommendations	Replace all pipe supports
Critical Item?	No

Observation Photos



SITE OBSERVATIONS

CHLORINE STORAGE

Observation Description	Chlorine Storage
Observation Details	The chlorine storage system presents several non-conformances: o No truck unloading bund is provided. The truck has to park on grass. o A trip hazard is present between the truck parking area and the transfer point. o No line drain system is provided, resulting in spilled chlorine every fill. o The safety shower is in direct sun but not insulated o The tank volume levels are not marked o The overflow is not plumbed into the bund and may spray beyond the bund o The tank vents into the room o The proximity to the bund is too close
Recommendations	Replace the entire chlorine storage system
Critical Item?	Yes

Observation Photos





HYPOCHLORITE SOLUTION
1791
2X
CORROSIVE
8
IN EMERGENCY DIAL 000, POLICE or FIRE BRIGADE
COOGEE 1800 800 655
DANGER
CHLORINE
TANK B


HYPOCHLORITE SOLUTION
1791
2X
IN EMERGENCY DIAL 000, POLICE or FIRE BRIGADE
TANK B

SITE OBSERVATIONS

ELECTRICAL INSTALLATION

Observation Description	Electrical Installation
Observation Details	The electrical installation is messy in some areas
Recommendations	It is recommended to engage an electrician to provide a condition and compliance audit
Critical Item?	Yes

Observation Photos



SITE OBSERVATIONS

OBSOLETE EQUIPMENT

Observation Description	Obsolete equipment
Observation Details	The room contains obsolete equipment
Recommendations	Remove all obsolete equipment
Critical Item?	No

Observation Photos

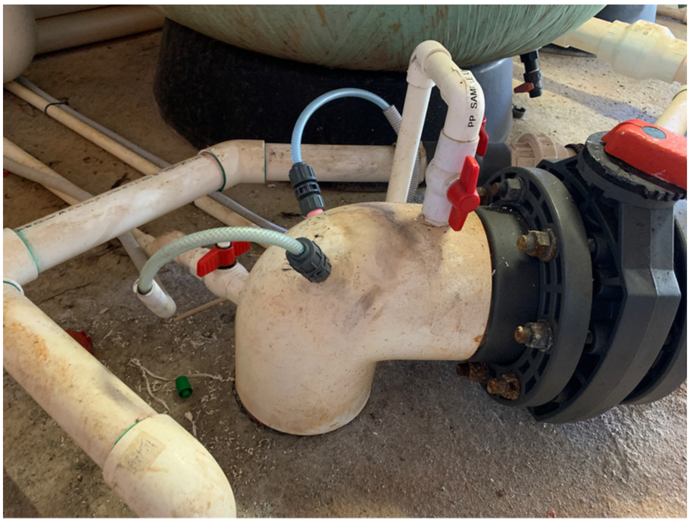



SITE OBSERVATIONS

LABELLING

Observation Description	Labelling
Observation Details	Labelling of pipework, equipment and injectors is poor
Recommendations	Label all equipment, pipework and injectors
Critical Item?	Yes

Observation Photos



SITE OBSERVATIONS

ACID STORAGE

Observation Description	Acid Storage
Observation Details	Acid is decanted into a 60L drum. This creates a manual handling risk and fume generation risk. This issue is increased by the pathway from the other plant rooms to this one for transferring chemicals
Recommendations	Investigate alternative pH correction options.
Critical Item?	No

Observation Photos

SITE OBSERVATIONS

ROOM LIGHTING

Observation Description	Room Lighting
Observation Details	Three of the room lights don’t work, creating a dark end to the plant room
Recommendations	Repair lights
Critical Item?	Yes

Observation Photos

WATER TREATMENT SYSTEMS

50M OUTDOOR POOL FILTRATION SYSTEM

System Identification	50m Outdoor Pool Filtration System

WATER TREATMENT PLANT AND EQUIPMENT

50M FILTRATION STRAINER

Equipment Type	Strainer ▸ Poly-Bodied Pre-Pump Strainer
Equipment Identifier	50m Filtration Strainer
Equipment Make	Jag Poly
Equipment Model	LLP150
Equipment Serial Number	N/A
Equipment Condition	2 - Good
Remaining Life (Years)	15
Replacement Cost ($)	7500

Equipment Photos

WATER TREATMENT PLANT AND EQUIPMENT

50M FILTRATION PUMP

Equipment Type	Pump ▸ Filtration Pump
Equipment Identifier	50m Filtration Pump
Equipment Make	Southern Cross
Equipment Model	200x150-315 15kW
Equipment Serial Number	21G2015A08
Equipment Condition	3 - Average
Remaining Life (Years)	6
Replacement Cost ($)	12000

Equipment Photos

Aquatic One
19/14 Ashtan Place
Banyo, Qld 4014

SITE OBSERVATIONS

FLOW SWITCH

Observation Description	Flow switch
Observation Details	The No-flow switch is broken. This may be causing the fault light on the control panel
Recommendations	Replace the flow switch and investigate the light
Critical Item?	No

Observation Photos

WATER TREATMENT PLANT AND EQUIPMENT

50M SAND FILTER 1

Equipment Type	Filter ▸ Sand Pressure Filter
Equipment Identifier	50m Sand Filter 1
Equipment Make	Poltank
Equipment Model	05110
Equipment Serial Number	03P008111
Equipment Condition	2 - Good
Remaining Life (Years)	20
Replacement Cost ($)	35000

Equipment Photos




WATER TREATMENT PLANT AND EQUIPMENT

50M SAND FILTER 2

Equipment Type	Filter ▸ Sand Pressure Filter
Equipment Identifier	50m Sand Filter 2
Equipment Make	Poltank
Equipment Model	05110
Equipment Serial Number	03P008112
Equipment Condition	2 - Good
Remaining Life (Years)	20
Replacement Cost ($)	35000

Equipment Photos

WATER TREATMENT PLANT AND EQUIPMENT

50M SAND FILTER 3

Equipment Type	Filter ▸ Sand Pressure Filter
Equipment Identifier	50m Sand Filter 3
Equipment Make	Poltank
Equipment Model	05110
Equipment Serial Number	03P008113
Equipment Condition	2 - Good
Remaining Life (Years)	20
Replacement Cost ($)	35000

Equipment Photos

WATER TREATMENT PLANT AND EQUIPMENT

50M SAND FILTER 4

Equipment Type	Filter ▸ Sand Pressure Filter
Equipment Identifier	50m Sand Filter 4
Equipment Make	Poltank
Equipment Model	05110
Equipment Serial Number	03P008110
Equipment Condition	2 - Good
Remaining Life (Years)	20
Replacement Cost ($)	35000

Equipment Photos

WATER TREATMENT PLANT AND EQUIPMENT

50M FLOW METER

Equipment Type	Ancillary Item ▸ Sensor
Equipment Identifier	50m Flow Meter
Equipment Make	Flomec
Equipment Model	RT401D0FA
Equipment Serial Number	2720-4628
Equipment Condition	4 - Poor
Remaining Life (Years)	10
Replacement Cost ($)	3000

Equipment Photos

SITE OBSERVATIONS

NOT WORKING

Observation Description	Not working
Observation Details	The flow meter is not working
Recommendations	Repair the flow meter
Critical Item?	No

Observation Photos

WATER TREATMENT PLANT AND EQUIPMENT

50M CHEMICAL CONTROLLER

Equipment Type	Chemical System ▸ Chemical Controller
Equipment Identifier	50m Chemical Controller
Equipment Make	Prominent
Equipment Model	DSR
Equipment Serial Number	N/A
Equipment Condition	5 - Very Poor
Remaining Life (Years)	0
Replacement Cost ($)	15000

Equipment Photos


SITE OBSERVATIONS

OBSOLETE CONTROLLER

Observation Description	Obsolete controller
Observation Details	The DSR controller is obsolete and at end of life. The pH probe can no longer be calibrated
Recommendations	Replace the chemical controller
Critical Item?	Yes

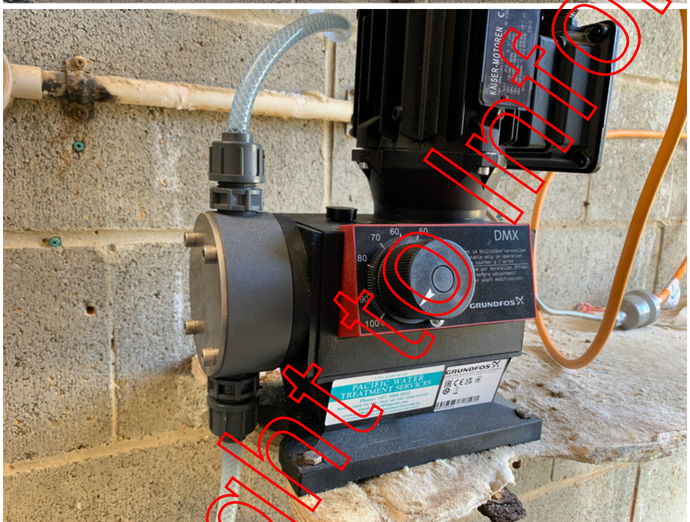
Observation Photos

WATER TREATMENT PLANT AND EQUIPMENT

50M CHLORINE DOSING PUMP

Equipment Type	Chemical System ▸ Chemical Dosing Pump
Equipment Identifier	50m Chlorine Dosing Pump
Equipment Make	Grundfos
Equipment Model	DMX 50-10
Equipment Serial Number	00000151
Equipment Condition	2 - Good
Remaining Life (Years)	6
Replacement Cost ($)	3500

Equipment Photos



SITE OBSERVATIONS

PUMP LEAK

Observation Description	Pump leak
Observation Details	A valve on the outlet is leaking
Recommendations	Repair the leak
Critical Item?	No

Observation Photos

WATER TREATMENT PLANT AND EQUIPMENT

50M HEATER CIRCULATION PUMP 1

Equipment Type	Pump ▸ Heater Circulation Pump
Equipment Identifier	50m Heater Circulation Pump 1
Equipment Make	Hayward
Equipment Model	Tri-Star VS
Equipment Serial Number	1B-SP3220HVS
Equipment Condition	3 - Average
Remaining Life (Years)	2
Replacement Cost ($)	2000

Equipment Photos

WATER TREATMENT PLANT AND EQUIPMENT

50M HEATER CIRCULATION PUMP 2

Equipment Type	Pump ▸ Heater Circulation Pump
Equipment Identifier	50m Heater Circulation Pump 2
Equipment Make	Hayward
Equipment Model	Tri-Star VS
Equipment Serial Number	1B-SP3220HVS
Equipment Condition	3 - Average
Remaining Life (Years)	2
Replacement Cost ($)	2000

Equipment Photos



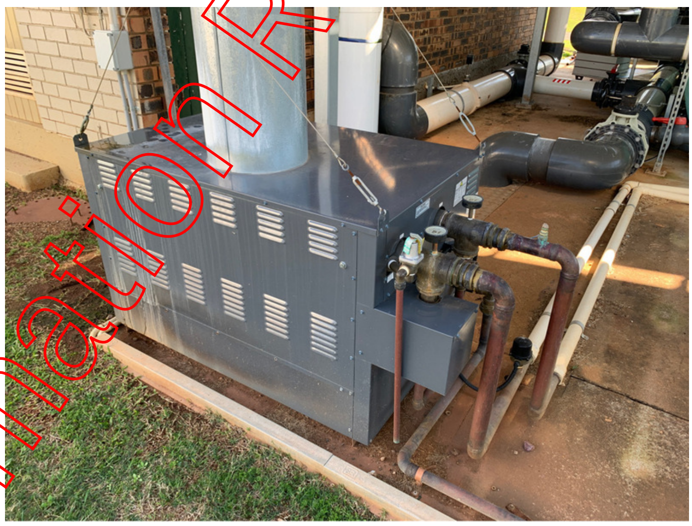
Aquatic One
19/14 Ashtan Place
Banyo, Qld 4014

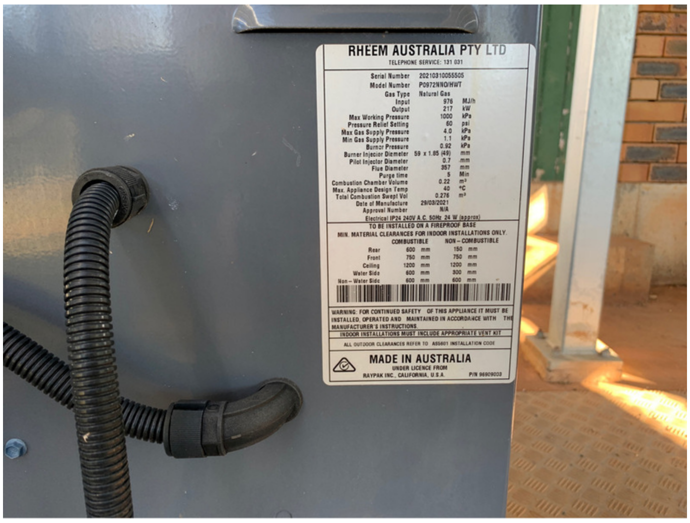
WATER TREATMENT PLANT AND EQUIPMENT

50M GAS HEATER 1

Equipment Type	Heating System ▸ Gas Heater - Direct Fired
Equipment Identifier	50m Gas Heater 1
Equipment Make	Raypak
Equipment Model	P0972NNO/HWT
Equipment Serial Number	20210310055505
Equipment Condition	2 - Good
Remaining Life (Years)	7
Replacement Cost ($)	25000

Equipment Photos



SITE OBSERVATIONS

GUTTER LEAK

Observation Description	Gutter leak
Observation Details	The roof gutter leaks and lands onto the heater, staining it
Recommendations	Repair the leak
Critical Item?	No

Observation Photos


WATER TREATMENT PLANT AND EQUIPMENT

50M GAS HEATER 2

Equipment Type	Heating System ▸ Gas Heater - Direct Fired
Equipment Identifier	50m Gas Heater 2
Equipment Make	Raypak
Equipment Model	P0972NNO/HWT
Equipment Serial Number	20190810051968
Equipment Condition	3 - Average
Remaining Life (Years)	5
Replacement Cost ($)	25000

Equipment Photos


WATER TREATMENT SYSTEMS

25M OUTDOOR POOL FILTRATION SYSTEM

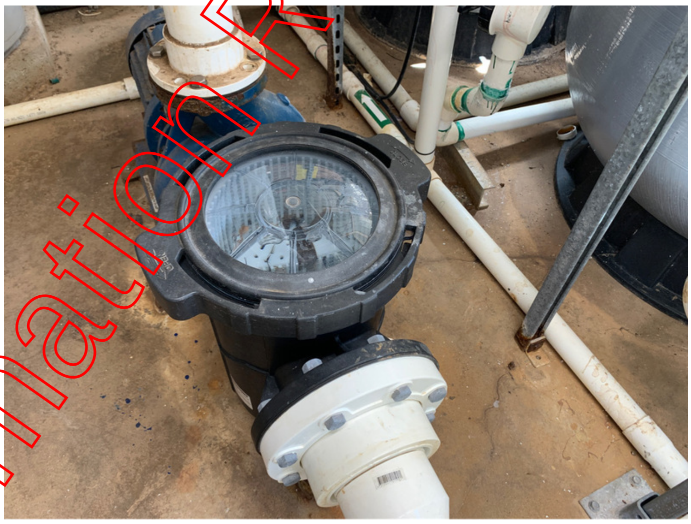
System Identification	25m Outdoor Pool Filtration System

WATER TREATMENT PLANT AND EQUIPMENT

25M FILTRATION STRAINER

Equipment Type	Strainer ▸ Plastic Pre-Pump Strainer
Equipment Identifier	25m Filtration Strainer
Equipment Make	Astral
Equipment Model	56733 25L Strainer
Equipment Serial Number	N/A
Equipment Condition	2 - Good
Remaining Life (Years)	8
Replacement Cost ($)	1000

Equipment Photos

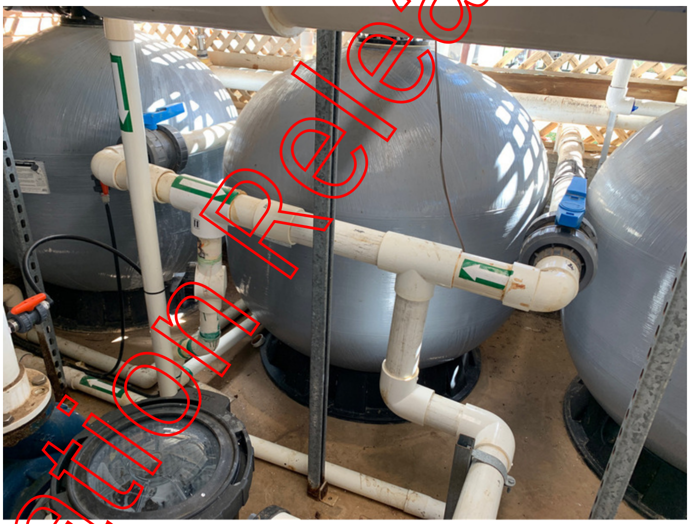


SITE OBSERVATIONS

SUCTION PIPEWORK

Observation Description	Suction Pipework
Observation Details	Suction pipework is undersized and likely restricting flow for the system.
Recommendations	Replumb the suction pipework
Critical Item?	No

Observation Photos

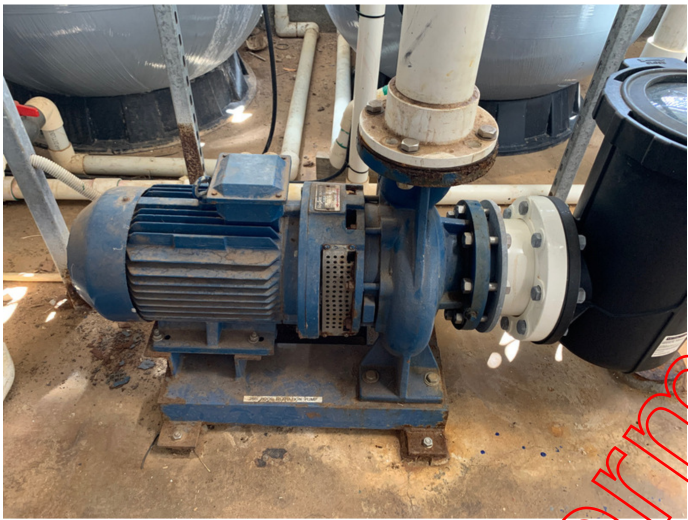


WATER TREATMENT PLANT AND EQUIPMENT

25M FILTRATION PUMP

Equipment Type	Pump ▸ Filtration Pump
Equipment Identifier	25m Filtration Pump
Equipment Make	Regent
Equipment Model	100-214-T41A 7.5kW
Equipment Serial Number	A72559MA132
Equipment Condition	4 - Poor
Remaining Life (Years)	5
Replacement Cost ($)	5000

Equipment Photos




WATER TREATMENT PLANT AND EQUIPMENT

25M SAND FILTER 1

Equipment Type	Filter ▸ Sand Pressure Filter
Equipment Identifier	25m Sand Filter 1
Equipment Make	Pentair
Equipment Model	V1200C
Equipment Serial Number	88010652
Equipment Condition	3 - Average
Remaining Life (Years)	15
Replacement Cost ($)	6000

Equipment Photos

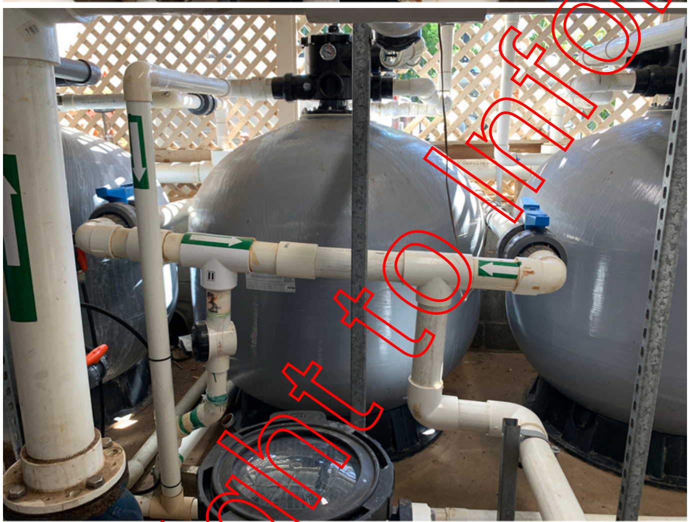
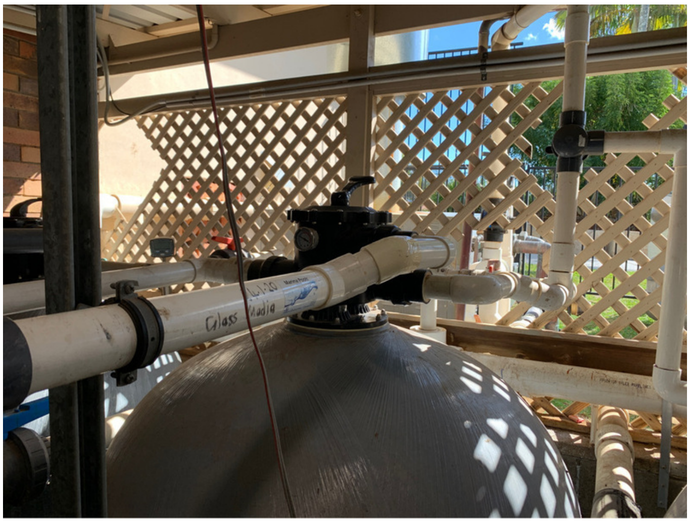
WATER TREATMENT PLANT AND EQUIPMENT

25M SAND FILTER 2

Equipment Type	Filter ▸ Sand Pressure Filter
Equipment Identifier	25m Sand Filter 2
Equipment Make	Pentair
Equipment Model	V1200C
Equipment Serial Number	1910-W-221
Equipment Condition	3 - Average
Remaining Life (Years)	15
Replacement Cost ($)	6000

Equipment Photos



WATER TREATMENT PLANT AND EQUIPMENT

25M SAND FILTER 3

Equipment Type	Filter ▸ Sand Pressure Filter
Equipment Identifier	25m Sand Filter 3
Equipment Make	Pentair
Equipment Model	V1200C
Equipment Serial Number	1910-W-110
Equipment Condition	3 - Average
Remaining Life (Years)	15
Replacement Cost ($)	6000

Equipment Photos




SITE OBSERVATIONS

MULTIPORT ACCESS

Observation Description	Multiport Access
Observation Details	Access to the filter multiport valves for 2 and 3 is very poor, requiring operators to step on/near poorly installed pipe. This situation is dangerous and likely to result in injury or pipe breakage.
Recommendations	As noted in the general plant layout, the room requires replacement due to access issues unable to be resolved with simple fixes.
Critical Item?	Yes

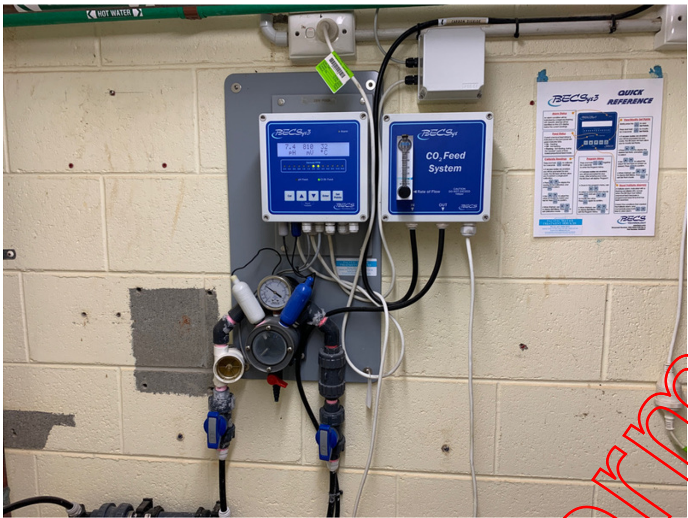
Observation Photos

WATER TREATMENT PLANT AND EQUIPMENT

25M CHEMICAL CONTROLLER

Equipment Type	Chemical System ▸ Chemical Controller
Equipment Identifier	25m Chemical Controller
Equipment Make	BecSYS
Equipment Model	System3
Equipment Serial Number	1100257008692
Equipment Condition	2 - Good
Remaining Life (Years)	7
Replacement Cost ($)	12500

Equipment Photos

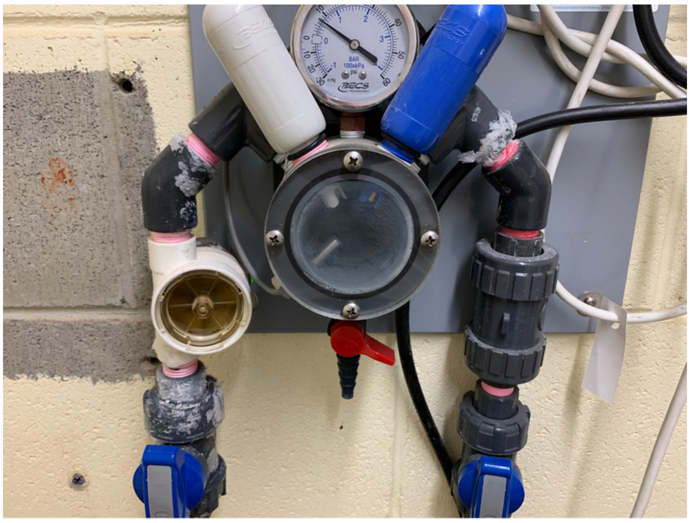


SITE OBSERVATIONS

FLOW CELL LEAKS

Observation Description	Flow Cell Leaks
Observation Details	The flow cell is leaking
Recommendations	Repair
Critical Item?	No

Observation Photos

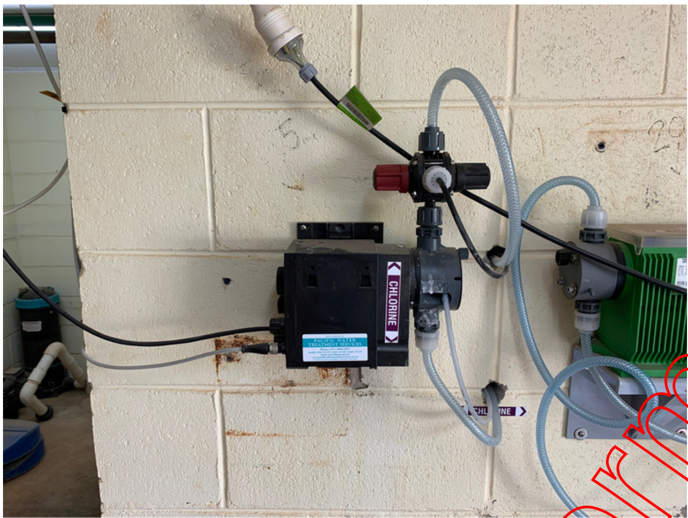


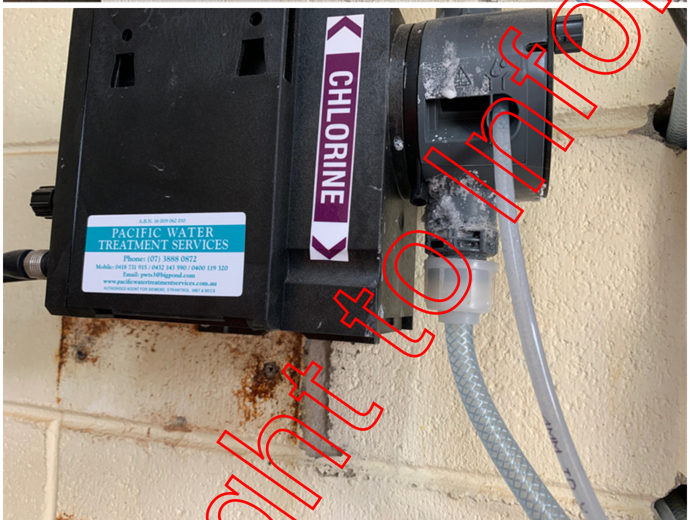
WATER TREATMENT PLANT AND EQUIPMENT

25M CHLORINE DOSING PUMP

Equipment Type	Chemical System ▸ Chemical Dosing Pump
Equipment Identifier	25m Chlorine Dosing Pump
Equipment Make	Grundfos
Equipment Model	DDE
Equipment Serial Number	N/A
Equipment Condition	4 - Poor
Remaining Life (Years)	3
Replacement Cost ($)	1500

Equipment Photos





SITE OBSERVATIONS

LEAK

Observation Description	Leak
Observation Details	The pump is leaking
Recommendations	Repair the pump
Critical Item?	Yes

Observation Photos

WATER TREATMENT PLANT AND EQUIPMENT

25M FLOW METER

Equipment Type	Ancillary Item ▸ Sensor
Equipment Identifier	25m Flow Meter
Equipment Make	Flomec
Equipment Model	RT401D0FA
Equipment Serial Number	2420-4497
Equipment Condition	4 - Poor
Remaining Life (Years)	10
Replacement Cost ($)	3000

Equipment Photos

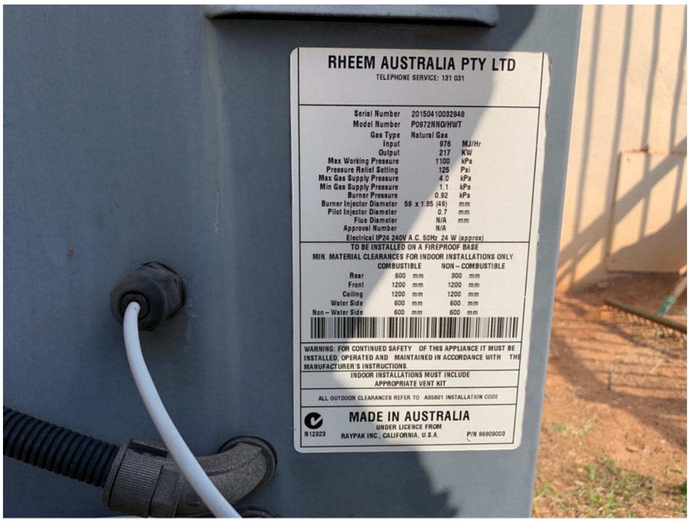
WATER TREATMENT PLANT AND EQUIPMENT

25M GAS HEATER

Equipment Type	Heating System ▸ Gas Heater - Direct Fired
Equipment Identifier	25m Gas Heater
Equipment Make	Raypak
Equipment Model	P0972NNO/HWT
Equipment Serial Number	20150410032848
Equipment Condition	4 - Poor
Remaining Life (Years)	4
Replacement Cost ($)	25000

Equipment Photos



WATER TREATMENT SYSTEMS

LTS POOL FILTRATION SYSTEM

System Identification	LTS Pool Filtration System

WATER TREATMENT PLANT AND EQUIPMENT

LTS FILTRATION STRAINER

Equipment Type	Strainer ▸ Poly-Bodied Pre-Pump Strainer
Equipment Identifier	LTS Filtration Strainer
Equipment Make	Jag Poly
Equipment Model	LLP30
Equipment Serial Number	N/A
Equipment Condition	3 - Average
Remaining Life (Years)	12
Replacement Cost ($)	4000

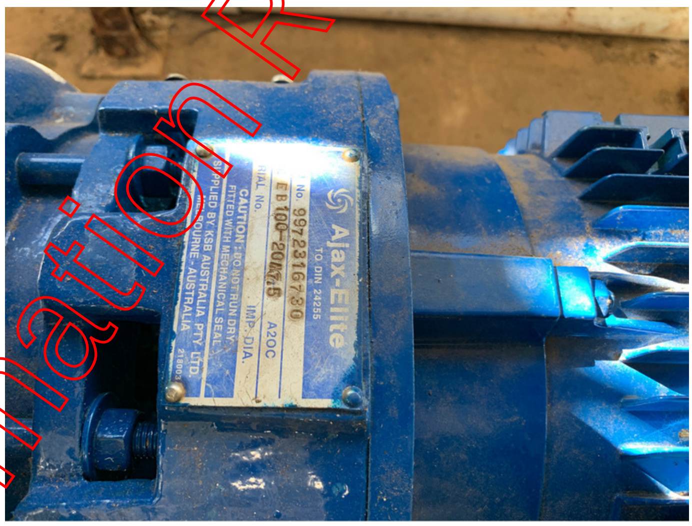
Equipment Photos

WATER TREATMENT PLANT AND EQUIPMENT

LTS FILTRATION PUMP

Equipment Type	Pump ▸ Filtration Pump
Equipment Identifier	LTS Filtration Pump
Equipment Make	Ajax Elite
Equipment Model	EB100-20M7.5
Equipment Serial Number	9972316730
Equipment Condition	4 - Poor
Remaining Life (Years)	5
Replacement Cost ($)	7000

Equipment Photos



WATER TREATMENT PLANT AND EQUIPMENT

LTS SAND FILTER 1

Equipment Type	Filter ▸ Sand Pressure Filter
Equipment Identifier	LTS Sand Filter 1
Equipment Make	Astral
Equipment Model	Berlin 1200
Equipment Serial Number	03E016695
Equipment Condition	4 - Poor
Remaining Life (Years)	3
Replacement Cost ($)	8500

Equipment Photos



WATER TREATMENT PLANT AND EQUIPMENT

LTS SAND FILTER 2

Equipment Type	Filter ▸ Sand Pressure Filter
Equipment Identifier	LTS Sand Filter 2
Equipment Make	Astral
Equipment Model	Berlin 1200
Equipment Serial Number	03E328015
Equipment Condition	4 - Poor
Remaining Life (Years)	3
Replacement Cost ($)	8500

Equipment Photos

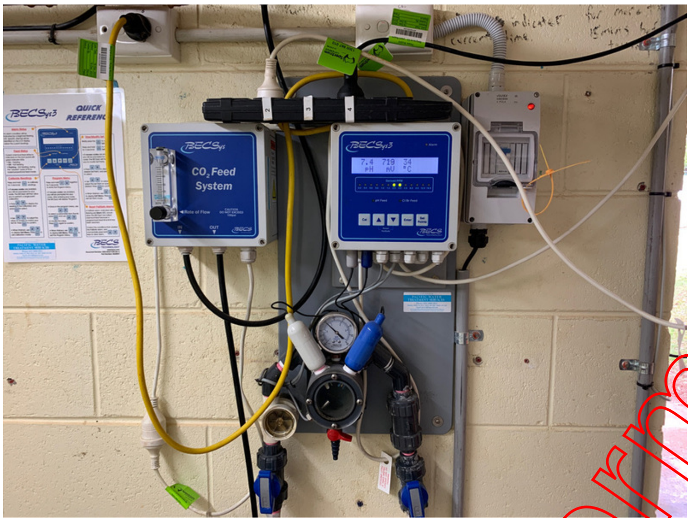


WATER TREATMENT PLANT AND EQUIPMENT

LTS CHEMICAL CONTROLLER

Equipment Type	Chemical System ▸ Chemical Controller
Equipment Identifier	LTS Chemical Controller
Equipment Make	BecSYS
Equipment Model	System3
Equipment Serial Number	1100257008527
Equipment Condition	2 - Good
Remaining Life (Years)	10
Replacement Cost ($)	12500

Equipment Photos

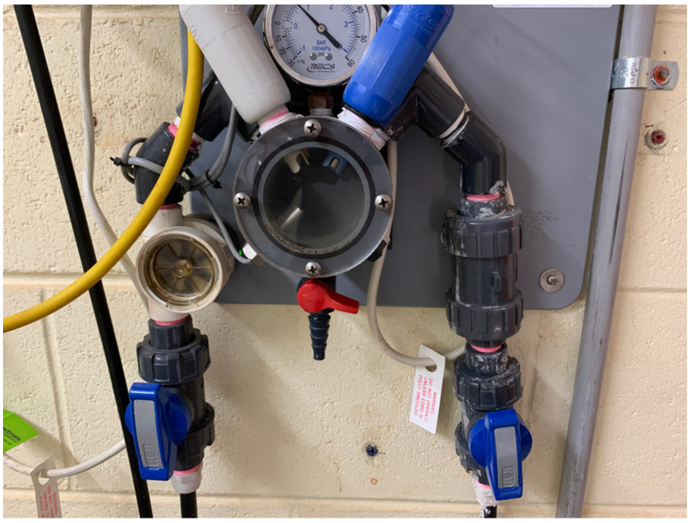


SITE OBSERVATIONS

FLOW CELL LEAK

Observation Description	Flow Cell Leak
Observation Details	The flow cell is leaking
Recommendations	Repair
Critical Item?	No

Observation Photos



WATER TREATMENT PLANT AND EQUIPMENT

LTS CHLORINE DOSING PUMP

Equipment Type	Chemical System ▸ Chemical Dosing Pump
Equipment Identifier	LTS Chlorine Dosing Pump
Equipment Make	Grundfos
Equipment Model	Aldos 208
Equipment Serial Number	06/42822
Equipment Condition	3 - Average
Remaining Life (Years)	3
Replacement Cost ($)	1500

Equipment Photos

WATER TREATMENT PLANT AND EQUIPMENT

LTS GAS HEATER

Equipment Type	Heating System ▸ Gas Heater - Direct Fired
Equipment Identifier	LTS Gas Heater
Equipment Make	Raypak
Equipment Model	PC0430-N
Equipment Serial Number	20180710049637
Equipment Condition	3 - Average
Remaining Life (Years)	6
Replacement Cost ($)	10000

Equipment Photos

WATER TREATMENT PLANT AND EQUIPMENT

LTS UV SYSTEM

Equipment Type	Chemical System ▸ Secondary Sanitation System
Equipment Identifier	LTS UV System
Equipment Make	Prominent
Equipment Model	Dulcodes 1x1S-17-DN100
Equipment Serial Number	20105165690
Equipment Condition	4 - Poor
Remaining Life (Years)	5
Replacement Cost ($)	17500

Equipment Photos

WATER TREATMENT PLANT AND EQUIPMENT

LTS FLOW METER

Equipment Type	Ancillary Item ▸ Sensor
Equipment Identifier	LTS Flow Meter
Equipment Make	Flomec
Equipment Model	RT401D0FA
Equipment Serial Number	N/A
Equipment Condition	3 - Average
Remaining Life (Years)	10
Replacement Cost ($)	3000

Equipment Photos

Aquatic One
19/14 Ashtan Place
Banyo, Qld 4014

SITE OBSERVATIONS

NOT WORKING

Observation Description	Not Working
Observation Details	The flow meter was not working at the time of the inspection
Recommendations	Repair the flow meter
Critical Item?	No

Observation Photos

WATER TREATMENT SYSTEMS

PLAY POOL FILTRATION SYSTEM

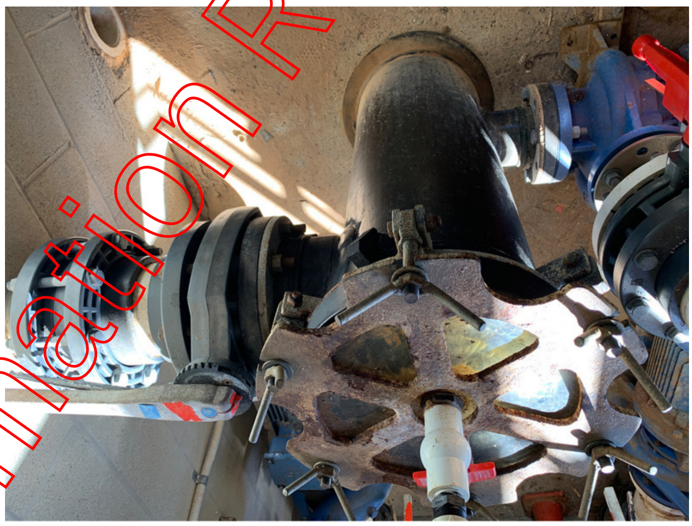
System Identification	Play Pool Filtration System

WATER TREATMENT PLANT AND EQUIPMENT

PLAY POOL FILTRATION STRAINER

Equipment Type	Strainer ▸ Poly-Bodied Pre-Pump Strainer
Equipment Identifier	Play Pool Filtration Strainer
Equipment Make	Unknown
Equipment Model	Unknown
Equipment Serial Number	N/A
Equipment Condition	4 - Poor
Remaining Life (Years)	3
Replacement Cost ($)	3500

Equipment Photos

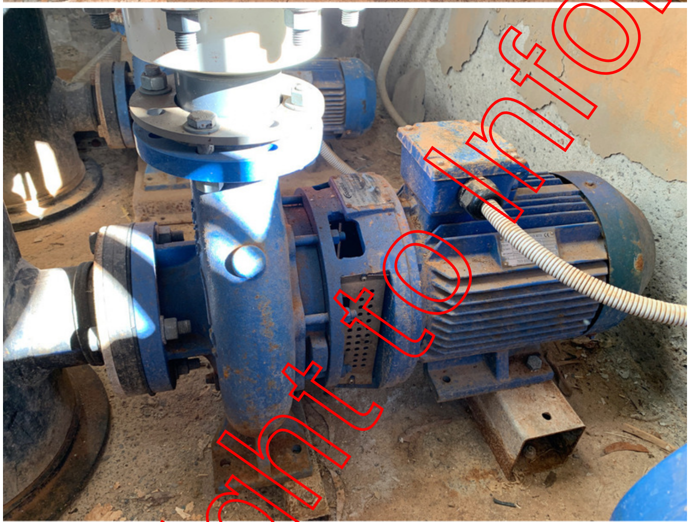


WATER TREATMENT PLANT AND EQUIPMENT

PLAY POOL FILTRATION PUMP

Equipment Type	Pump ▸ Filtration Pump
Equipment Identifier	Play Pool Filtration Pump
Equipment Make	Aquaplus
Equipment Model	ESDM 80-200 5.5kW
Equipment Serial Number	020V01677
Equipment Condition	5 - Very Poor
Remaining Life (Years)	0
Replacement Cost ($)	5000

Equipment Photos

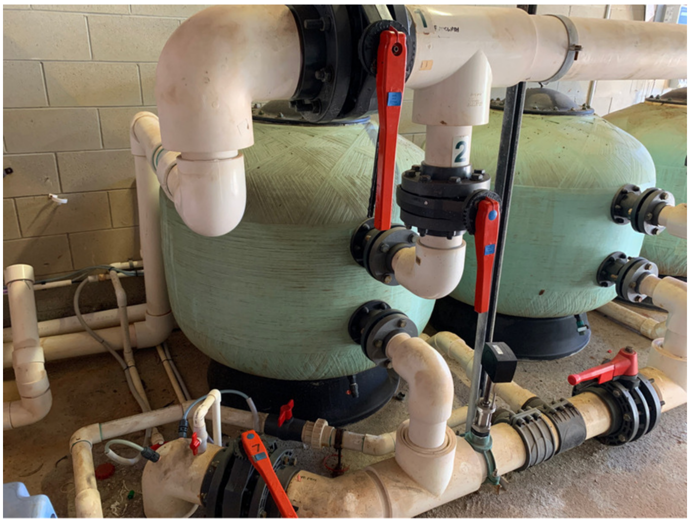


WATER TREATMENT PLANT AND EQUIPMENT

PLAY POOL SAND FILTER 1

Equipment Type	Filter ▸ Sand Pressure Filter
Equipment Identifier	Play Pool Sand Filter 1
Equipment Make	Astral
Equipment Model	Berlin 1200
Equipment Serial Number	03E017313
Equipment Condition	3 - Average
Remaining Life (Years)	8
Replacement Cost ($)	8500

Equipment Photos

WATER TREATMENT PLANT AND EQUIPMENT

PLAY POOL SAND FILTER 2

Equipment Type	Filter ▸ Sand Pressure Filter
Equipment Identifier	Play Pool Sand Filter 2
Equipment Make	Astral
Equipment Model	Berlin 1200
Equipment Serial Number	03E01661
Equipment Condition	3 - Average
Remaining Life (Years)	8
Replacement Cost ($)	8500

Equipment Photos

WATER TREATMENT PLANT AND EQUIPMENT

PLAY POOL SAND FILTER 3

Equipment Type	Filter ▸ Sand Pressure Filter
Equipment Identifier	Play Pool Sand Filter 3
Equipment Make	Astral
Equipment Model	Berlin 1200
Equipment Serial Number	03E016635
Equipment Condition	3 - Average
Remaining Life (Years)	8
Replacement Cost ($)	8500

Equipment Photos

WATER TREATMENT PLANT AND EQUIPMENT

PLAY POOL FLOW METER

Equipment Type	Ancillary Item ▸ Sensor
Equipment Identifier	Play Pool Flow Meter
Equipment Make	Flomec
Equipment Model	RT401D0FA
Equipment Serial Number	24220-4496
Equipment Condition	2 - Good
Remaining Life (Years)	10
Replacement Cost ($)	3000

Equipment Photos

Aquatic One
19/14 Ashtan Place
Banyo, Qld 4014

WATER TREATMENT PLANT AND EQUIPMENT

PLAY POOL CHEMICAL CONTROLLER

Equipment Type	Chemical System ▸ Chemical Controller
Equipment Identifier	Play Pool Chemical Controller
Equipment Make	BecSYS
Equipment Model	System 3
Equipment Serial Number	1100257011879
Equipment Condition	2 - Good
Remaining Life (Years)	12
Replacement Cost ($)	12500

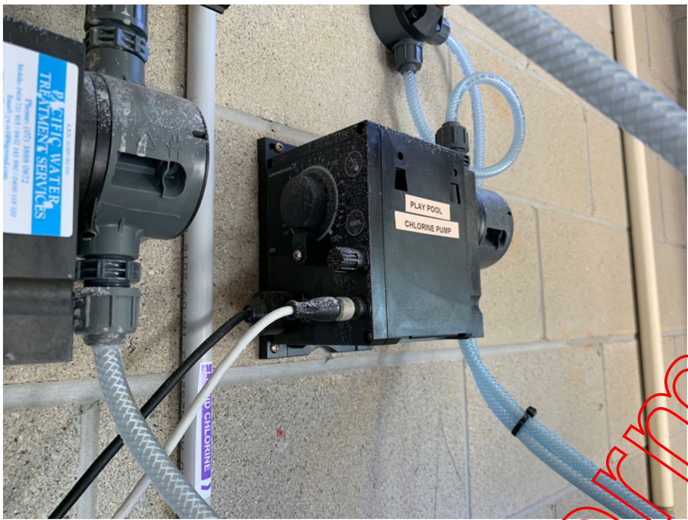
Equipment Photos

WATER TREATMENT PLANT AND EQUIPMENT

PLAY POOL CHLORINE DOSING PUMP

Equipment Type	Chemical System ▸ Chemical Dosing Pump
Equipment Identifier	Play Pool Chlorine Dosing Pump
Equipment Make	Grundfos
Equipment Model	DDE
Equipment Serial Number	N/A
Equipment Condition	2 - Good
Remaining Life (Years)	8
Replacement Cost ($)	1500

Equipment Photos



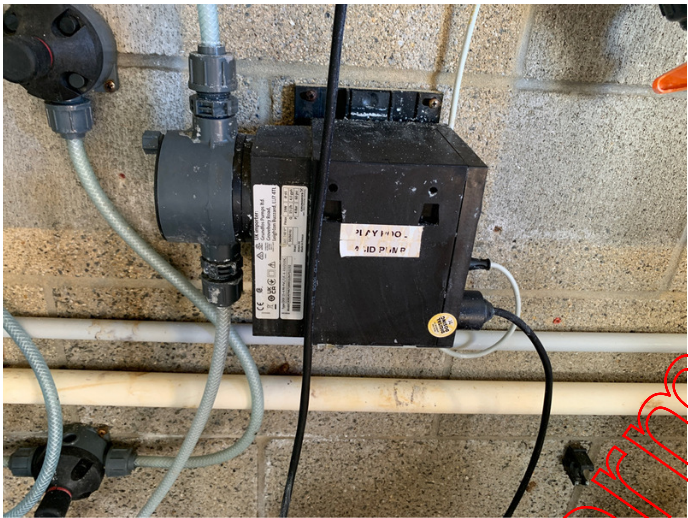
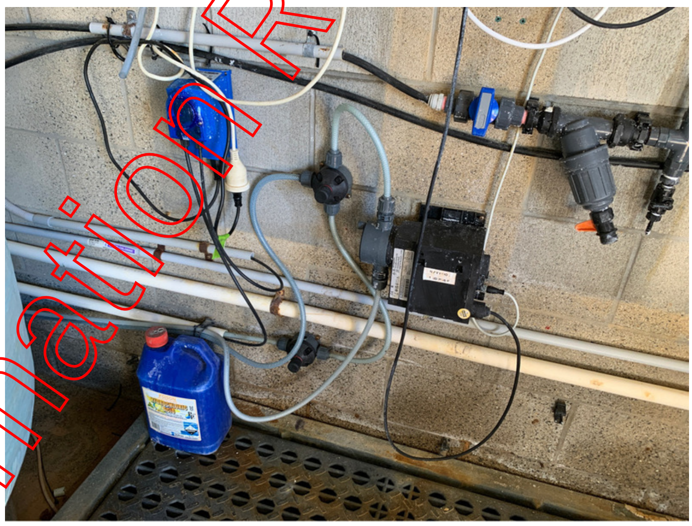
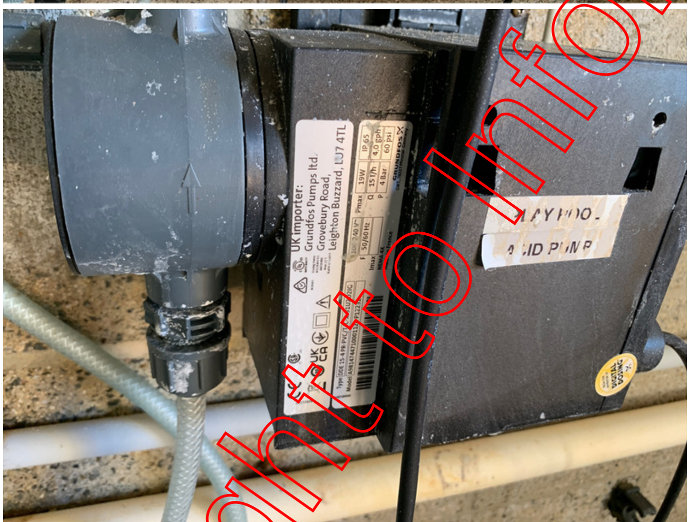


WATER TREATMENT PLANT AND EQUIPMENT

PLAY POOL ACID DOSING PUMP

Equipment Type	Chemical System ▸ Chemical Dosing Pump
Equipment Identifier	Play Pool Acid Dosing Pump
Equipment Make	Grundfos
Equipment Model	DDE 15-4
Equipment Serial Number	N/A
Equipment Condition	2 - Good
Remaining Life (Years)	8
Replacement Cost ($)	1500

Equipment Photos

WATER TREATMENT PLANT AND EQUIPMENT

PLAY POOL FEATURE PUMP

Equipment Type	Pump ▸ Water Feature Pump
Equipment Identifier	Play Pool Feature Pump
Equipment Make	Davey
Equipment Model	N/A
Equipment Serial Number	N/A
Equipment Condition	3 - Average
Remaining Life (Years)	3
Replacement Cost ($)	1500

Equipment Photos


DAVEY


DAVEY

WATER TREATMENT SYSTEMS

RAPID RIVER POOL FILTRATION SYSTEM

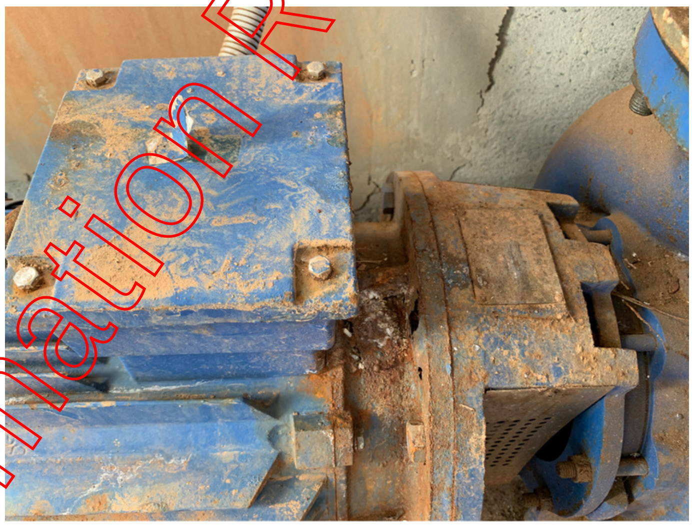
System Identification	Rapid River Pool Filtration System

WATER TREATMENT PLANT AND EQUIPMENT

RIVER PUMP 1

Equipment Type	Pump ▸ Water Feature Pump
Equipment Identifier	River Pump 1
Equipment Make	Aquaplus
Equipment Model	ESDM 125 200 11kW
Equipment Serial Number	020V00769/2
Equipment Condition	4 - Poor
Remaining Life (Years)	2
Replacement Cost ($)	10000

Equipment Photos

WATER TREATMENT PLANT AND EQUIPMENT

RIVER PUMP 2

Equipment Type	Pump ▸ Water Feature Pump
Equipment Identifier	River Pump 2
Equipment Make	Aquaplus
Equipment Model	ESDM 125 200 11kW
Equipment Serial Number	020V00769
Equipment Condition	4 - Poor
Remaining Life (Years)	2
Replacement Cost ($)	10000

Equipment Photos

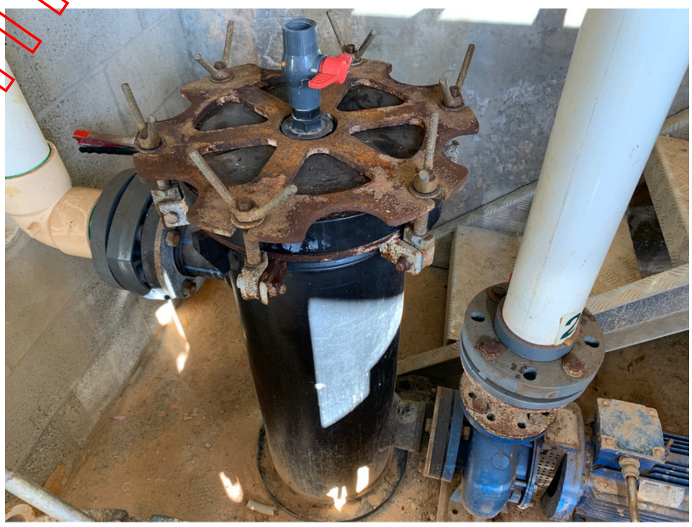

MONARCH

WATER TREATMENT PLANT AND EQUIPMENT

RIVER POOL FILTRATION STRAINER

Equipment Type	Strainer ▸ Poly-Bodied Pre-Pump Strainer
Equipment Identifier	River Pool Filtration Strainer
Equipment Make	Unknown
Equipment Model	Unknown
Equipment Serial Number	N/A
Equipment Condition	4 - Poor
Remaining Life (Years)	4
Replacement Cost ($)	3500

Equipment Photos

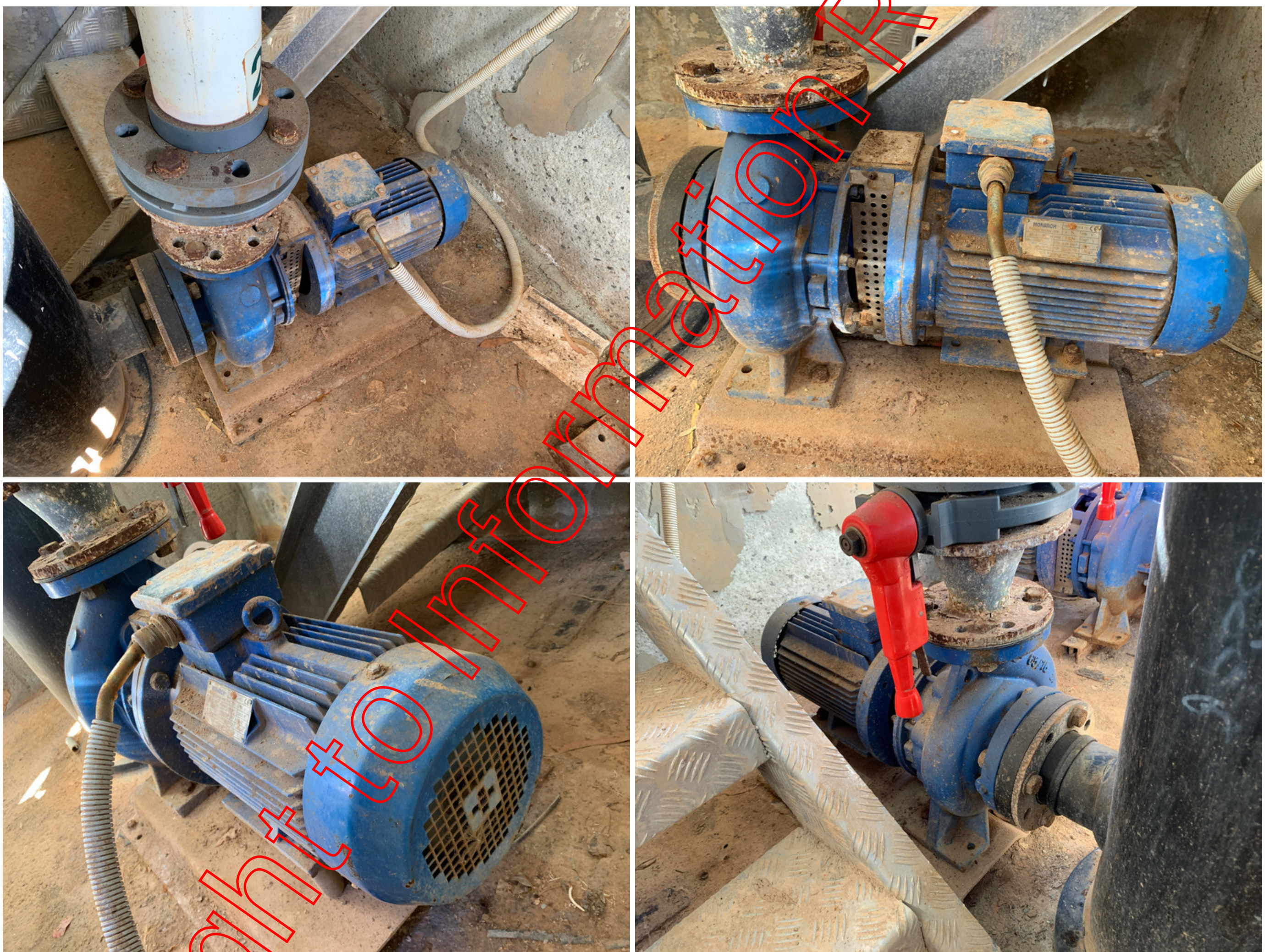


WATER TREATMENT PLANT AND EQUIPMENT

RIVER POOL FILTRATION PUMP

Equipment Type	Pump ▸ Filtration Pump
Equipment Identifier	River Pool Filtration Pump
Equipment Make	Aquaplus
Equipment Model	ESDM 65-160 2.2kW
Equipment Serial Number	020V00830
Equipment Condition	4 - Poor
Remaining Life (Years)	4
Replacement Cost ($)	4500

Equipment Photos



WATER TREATMENT PLANT AND EQUIPMENT

RIVER POOL SAND FILTER 1

Equipment Type	Filter ▸ Sand Pressure Filter
Equipment Identifier	River Pool Sand Filter 1
Equipment Make	Astral
Equipment Model	Berlin 1200
Equipment Serial Number	03C834849
Equipment Condition	3 - Average
Remaining Life (Years)	8
Replacement Cost ($)	8500

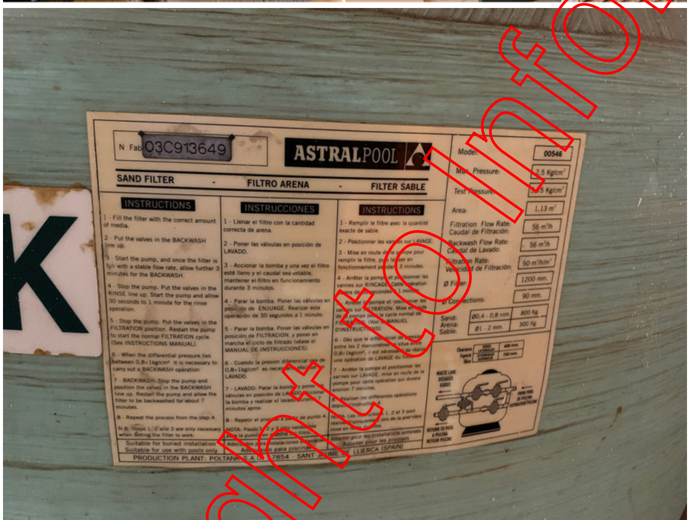
Equipment Photos

WATER TREATMENT PLANT AND EQUIPMENT

RIVER POOL SAND FILTER 2

Equipment Type	Filter ▸ Sand Pressure Filter
Equipment Identifier	River Pool Sand Filter 2
Equipment Make	Astral
Equipment Model	Berlin 1200
Equipment Serial Number	03C913649
Equipment Condition	3 - Average
Remaining Life (Years)	8
Replacement Cost ($)	8500

Equipment Photos



WATER TREATMENT PLANT AND EQUIPMENT

RIVER POOL SAND FILTER 3

Equipment Type	Filter ▸ Sand Pressure Filter
Equipment Identifier	River Pool Sand Filter 3
Equipment Make	Astral
Equipment Model	Berlin 1200
Equipment Serial Number	03E016401
Equipment Condition	3 - Average
Remaining Life (Years)	8
Replacement Cost ($)	8500

Equipment Photos


WATER TREATMENT PLANT AND EQUIPMENT

RIVER POOL FLOW METER

Equipment Type	Ancillary Item ▸ Sensor
Equipment Identifier	River Pool Flow Meter
Equipment Make	Flomec
Equipment Model	RT401D0FA
Equipment Serial Number	3720-4701
Equipment Condition	2 - Good
Remaining Life (Years)	10
Replacement Cost ($)	3000

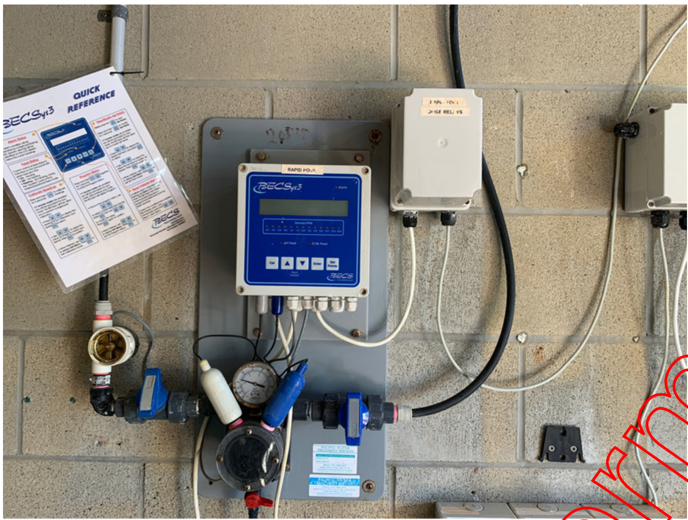
Equipment Photos

WATER TREATMENT PLANT AND EQUIPMENT

RIVER POOL CHEMICAL CONTROLLER

Equipment Type	Chemical System ▸ Chemical Controller
Equipment Identifier	River Pool Chemical Controller
Equipment Make	BecSYS
Equipment Model	System3
Equipment Serial Number	11002570086
Equipment Condition	3 - Average
Remaining Life (Years)	10
Replacement Cost ($)	12500

Equipment Photos

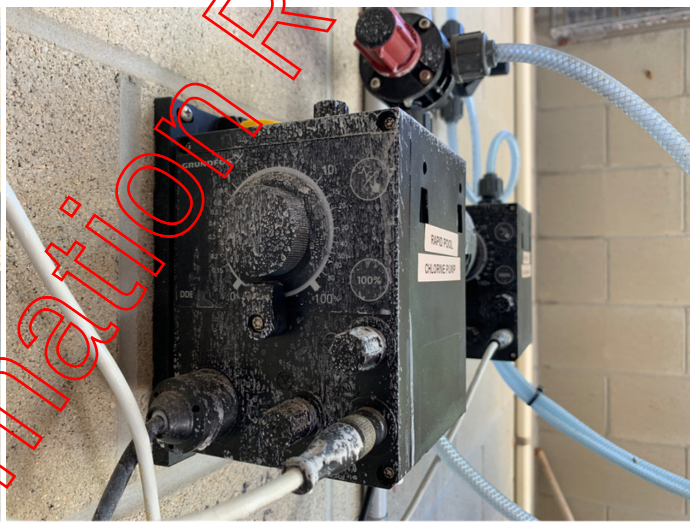


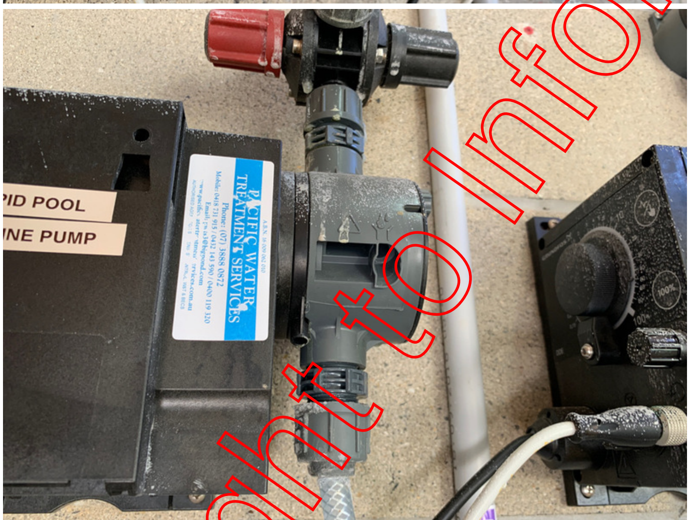
WATER TREATMENT PLANT AND EQUIPMENT

RIVER POOL CHLORINE DOSING PUMP

Equipment Type	Chemical System ▸ Chemical Dosing Pump
Equipment Identifier	River Pool Chlorine Dosing Pump
Equipment Make	Grundfos
Equipment Model	DDE
Equipment Serial Number	N/A
Equipment Condition	3 - Average
Remaining Life (Years)	3
Replacement Cost ($)	1500

Equipment Photos



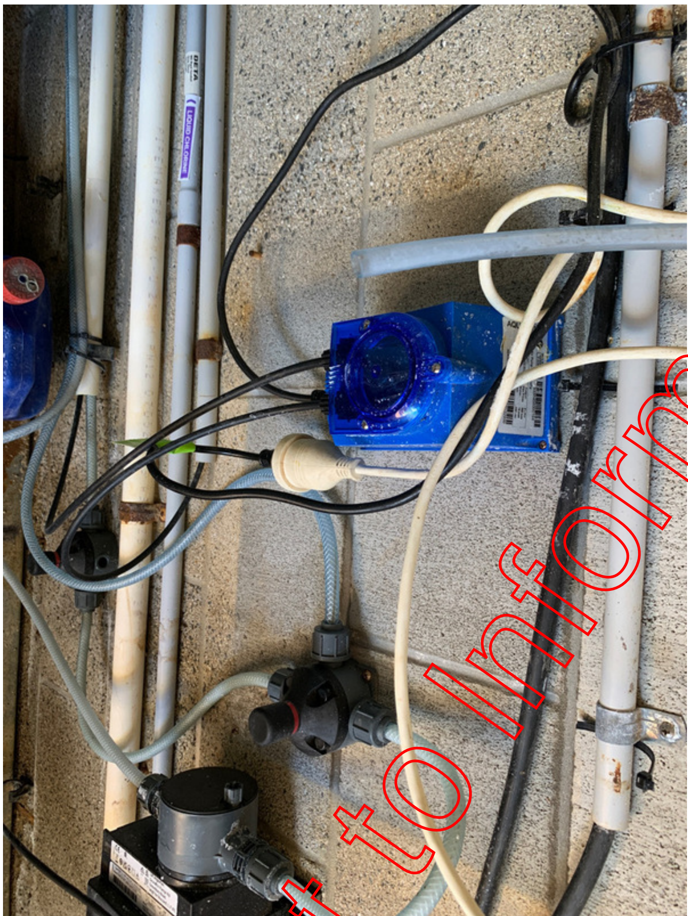


WATER TREATMENT PLANT AND EQUIPMENT

RIVER POOL ACID DOSING PUMP

Equipment Type	Chemical System ▸ Chemical Dosing Pump
Equipment Identifier	River Pool Acid Dosing Pump
Equipment Make	Aquarius
Equipment Model	AP_Peri3
Equipment Serial Number	1509AP3021783
Equipment Condition	4 - Poor
Remaining Life (Years)	1
Replacement Cost ($)	900

Equipment Photos



WATER TREATMENT PLANT AND EQUIPMENT

RIVER POOL WATERFALL PUMP

Equipment Type	Pump ▸ Water Feature Pump
Equipment Identifier	River Pool Waterfall Pump
Equipment Make	Hayward
Equipment Model	Super II Eco
Equipment Serial Number	SPC3010CDI
Equipment Condition	2 - Good
Remaining Life (Years)	3
Replacement Cost ($)	1500

Equipment Photos