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REPORT ON CONDITION AND REMEDIATION WORKS

ROEBOURNE COMMUNITY AQUATIC CENTRE

20 AUGUST 2016

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1.0 EXECUTIVE SUMMARY

1. Pool is estimated to be losing 15,750 litres/day.

2. Both the pool joints and main filtered water supply lines to the pool which also run under the pool are leaking. There is dirt in the supply line. The pool joints need to run across the floor, up the walls and into the gutters and around them to hold the water in the pool zone.

3. Pool has settled unevenly by approximately 5mm.

4. The concourse ponds and requires relaying to falls to drainage pits that run to waste.

5. The balance tank is too small for proper backwash so multiple back washes are needed and time is required to continuously fill the tank. This requires a larger tank to be built or a supply line laid to the main pool that can be opened while a backwash occurs to fill the balance tank up.

6. The gutters are too small and in poor condition and overflow in sections when the pool is being used. They require to be rebuilt to correct the size or renovated and additional droppers installed to take the water to a new soiled water pipe set under the concourse. New grating to gutters is needed and rectifying of the wetdeck.

7. The existing render requires removal as it is very sharp and covered in algae and re-rendered. A Chadson render is smooth and would last 10-15 years, or the pool could be tiled that should last 20-30 years.

8. The plant is generally working ok. Geoff Ninnes Fong & Partners would suggest inclusion of a UV unit to kill all pathogens that pass through it in the pool water. There is rusting to the plantroom sheeting and some structural components.

1.1 General Comments

a. Leave the pool as it is.

   The pool should not be left as it is due to known problems with joint and pipe leakage and very sharp render with high algae infestations.

   If nothing is done the leaks will increase until the supply pipe fails when nothing will operate and injuries will occur with the sharp render.

   The plant will continue to operate until pipes fail.

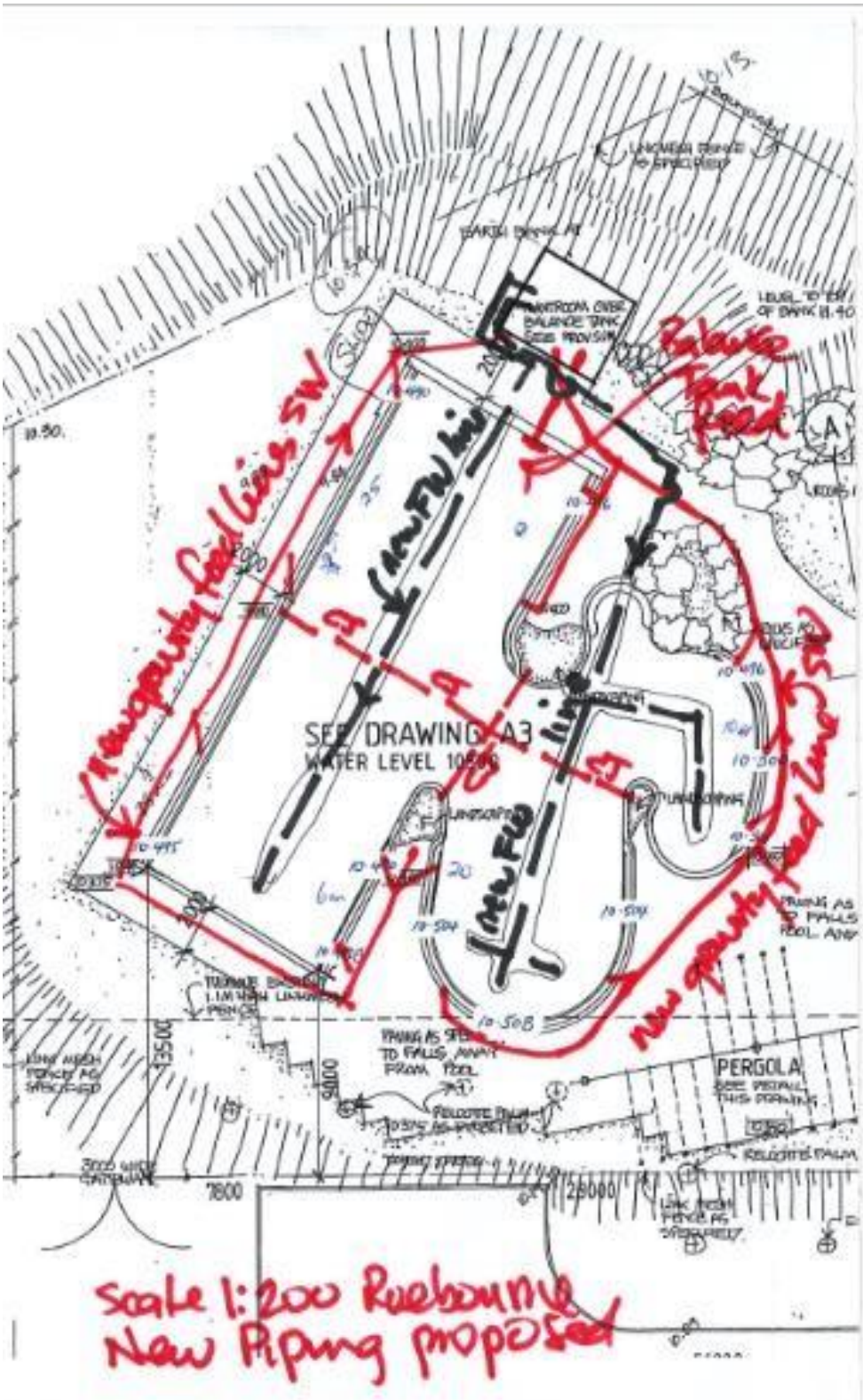
b. Minimum work assessment (Perth prices, exclusive of GST)

ITEM	Total (excl. GST)	GST	Total (incl. GST)
Remove old render (allow \$40/m^2 x 550)	\$22,000	\$2,200	\$24,200
Render the pool (allow \$80/m^2 x 550)	\$44,000	\$4,400	\$48,400
Replace the pipes in the pool floor, rubber ring joint (allow \$2,000/m x 50)	\$100,000	\$10,000	\$110,000

Redo the joints with combliflex and maxisil P joint (allow $600/m x 30)	$18,000	$1,800	$19,800
Renovate existing gutter, cutting, patching, levelling, coating, retiling area, new grates (allow $200/m x 70m)	$14,000	$1,400	$15,400
Place new droppers and new line to take soiled water to the balance tank, rubber ring joints	$80,000	$8,000	$88,000
Fill system from balance tank to pool	$10,000	$1,000	$11,000
TOTAL	**$288,000**	**$28,800**	**$316,800**

This does not include a UV system ($40,000) or lifting the paving to give falls to a drainage system.

With this work undertaken we would expect another 15 years of life in the pool with the provision that joint sealant has a maximum 10 year life and render 10-15 year life. The pool sits on reactive clay so relevelling of the gutters may be required every 10-15 years.


Balance Tank Roof
New gravity feed lines SW
New gravity feed lines SW
SEE DRAWING A3
WATER LEVEL 10.00
PERGOLA
Scale 1:200 Roebourne
New Piping proposed

2.0 FACILITY SPECIFICATIONS

2.1 Dimensions

- 25m x 9m lap length (4 lanes) plus 172m^2 of leisure including an in-pool spa
- Total pool area 420m^2
- Total pool volume 440m^3
- Estimated plant size 110m^3/hr (30l/sec)
- Current T/O 4hour
- W.A. Health (current) requirement 1 – 1.5 hour
- Pipe supply size to lap area NB100 with 12NB50 inlets
- Pipe supply size to leisure area NB100 with 9NB50 inlets
- Total filter area 3.0
- Filters 1 x MHS-125 (now called MHS3000)
- Filter rate 37m^3/hr/m^2
- Backwash rate 42 m^3/hr/m^2
- Backwash flow 35l/sec

2.2 Materials

- Pool structure sprayed concrete with small sprayed gutters
- Surface finish exposed aggregate render in poor condition
- Constructed 1992 (24 years old)

2.3 Balance Tanks and Backwash Tank (above ground)

- 4m x 4.5m x 2.3m total depth. Effective depth 1.0m. Inlets from gutters 1.2m below BT roof
- Effective volume 16m^3
- Backwash volume required 8m^3
- Backwash tank volume 9.9m^3, top of tank 2.5m above plantroom floor. Tank 2.1m high, diameter 2.4m approximately
  Note:- The balance tank requires an access ladder.

2.4 Water Temperature

- Summer 35^{0}C
- Shoulder 30^{0}C
- Operates 1 September to end of May

2.5 Gutters

- Very small, 175 wide, variable depth 150 to 450 deep (modern gutters are minimum 250 wide, 300 deep)
- Dropper from gutter NB100 to connect to a NB150NB gravity feed line to balance tank

3.0 ASSET CONDITION REPORT

3.1 Pool Shell

- Numerous small rust spots are evident throughout the pool surface, particularly in the leisure pool area. Management staff have previously noted that rust was coming through the render surface
- Coping tiling of variable quality – some poor

- Sprayed construction thus walls curve into floors
- Sprayed gutters poorly created and require upgrade
- Grating runs in wrong direction which allows water to overflow on to concourse in some areas
- Mayor algae spread through the pool
- The pool shell has settled unevenly more than 5mm and this causes flow over the gutter lip when pool in use and uneven flow in to gutters
- Gutters are too small for the current flow when pool is in use and overflow to concourse
- Pool has 1 years of its design life left.

NOTE: Sprayed construction should not normally be used for commercial pools. Design life is only 25 years while formed and poured has a 50 year design life.

3.2 Pool Surface

- Very sharp render surface which is unsafe and requires replacement. GNFP recommend DIN Standard tiles or Chadson renders system with a 10 year life.
- Render is rapidly breaking down to give sharp exposed grit. The render was noted as breaking down almost immediately after construction
- The surface in the leisure pool area is most degraded, particularly in the toddlers wading area where the surface is increasingly uncomfortable to walk on
- Algae (black spot) covers much of the pool radius and walls due to poor circulation and convenient holes in the render in which it can exit

3.3 Regulatory and Information Markings

- Minimum pool depth signage apparent, additional signage required to conform with W.A. Health at 7.5m centres
- General signage for plantroom, gas chlorine satisfactory

3.4 Concourse

- Concourse is brick paving which in some locations is wearing, giving an uneven rough surface
- There is no drainage to the concourse slabs with surface water falling towards the lawns where it ponds
- Clayey soils around perimeter of concourse do not accept run off causing pooling of run off
- There is a small area under the slide that has a rubber soft fall surface installed and a drain to collect excessive water
- Concourse has settled unevenly causing substantial ponding of water. Suggest relaying concourse with drainage pits with drainage lines to stormwater

3.5 Fittings including lane rope holders and starting blocks

- Cup anchors provided for lane ropes. There are no starting blocks

3.6 Scum Gutters

The design of this pool uses a wet deck gutter to skim off soiled surface water. The gutters are really much too small, both in width and depth, for the water flow in the pool, and in some locations flood as water can run across the gutter grate and onto the concourse. The surface of the inside of the gutters is very rough and the constant water flow has caused some recesses and holes in the concrete that require correction. The method of transfer of water from gutter to balance tanks is via a NB100 pipe set in the floor of the gutter with a small basket inset into it to collect hair and leaves. This basket periodically fills with debris and blocks the flow of water into the pipe to the balance tank. A leaf pit with screens should be installed immediately before the pool

water enters the balance tank. Also vertical removable screens should be installed in the gutters.

Option 1 – Gutter Droppers to a New Soiled Water Pipe to Balance Tank

The following rectification is required to the gutters:-

(i) Remove the baskets in all the soiled water lines and replace with vertical mesh screens and a leaf pit
(ii) Cut in additional soiled water lines to the gutters to aid water removal and run these separately back to the new leaf pit then to balance tank
(iii) Re-level the top of gutters so preferential flow to a corner does not occur, change grate to longitudial
(iv) Remove all rough concrete to base and sides of gutters, open up holes and pack with Nitobond and Renderoc-HP, skim coat with approved thin bed render, coat with cementitious lining
(v) The tiling to much of the gutter sections is in a poor state and requires replacement. Base render has failed and tiles were installed with minimal joints
(vi) Increase the size of balance tank by 2x or install a new pool waterline from the pool to balance tank for rapid fill

Option 2 – Replacement of Gutters

This option is where the existing gutters are chopped off the pool structure and new gutters then correctly built. This is a much more expensive option then option 1 however in the long run it would work the best for the project as it could be built to fit the flow of the pool and only return lines at each end of the pool gutter would collect the soiled water and take back to the balance tank.

3.7 Inlet Nozzles

- There are sufficient inlet nozzles to accommodate the existing flow. If the pool only is upgraded, WA Health would not require upgrade in plant. Currently we believe the filtered water lines run under the pool and any differential movement can crack or break the nozzle system. Testing of the filtered water lines indicated pipe leakage. Geoff Ninnes Fong & Partners would recommend new filtered waterlines set in the pool shell and running back to the plant room.

3.8 Ladder access ramps and hydraulic lifts

- There is normal and sufficient access to the pools through step treads and gradients and through the beach area of the pool for disabled access.

3.9 Feature Equipment

- The features on this pool are a slide system and an in-pool spa. Both work acceptably.

3.10 Pool Joints

- The original design was rearguard waterstop with surface joint material with backing rod.
- Original surface joint Emerseal replaced 2003, expected life 5 years maximum and has now failed and required replacement. All joints require to be rebuilt with new external waterstop and new pure silicone sealant (Maxisil-P) as the current joints have failed. In addition Geoff Ninnes Fong & Partners believe that the rear guard waterstop to the joints is not working. As the pool is sprayed concrete rebound would prevent proper compaction of concrete to the rear guards. A new pool water side waterstop (Combiflex) is required to prevent general water loss as the pool cannot just rely on sealant to do so.

3.11 Fencing

- Satisfactory

3.12 Entry Control point

- Satisfactory

3.13 Changeroom Areas

- Satisfactory

3.14 Plantroom Areas

The plant is working reasonably well.
The gas chlorine is generally good. Refer to Hydramet report.
The balance tank requires an access ladder.

In summary the plantroom building structure needs derusting in some sections and sections replaced in others to enable the building to satisfactorily function structurally in a cyclone.

3.15 Storerooms

- Satisfactory

3.16 Office and Control Points

- Satisfactory

3.17 Kiosk/Café Preparation and Service Areas

- Satisfactory but cramped

3.18 Toilet and Shower Areas

- Satisfactory

3.19 Shade Shelters

- Satisfactory

3.20 In-pool and Surround Lighting

- No in-pool lighting
- Surround lighting satisfactory

3.21 Landscaping and Patron Amenity

- Satisfactory

3.22 Electrical

- This has not been rechecked
- Existing RCD's failed test
- Require the electrics to be checked and certified
- AS3760 requires proof of working so requires an Electrical Certificate from a registered electrician

3.23 Equi Potential Bonding

- GNFP understand that system complies with major items but that small items still need to be checked
- All earthing goes back to main building switchboard

3.24 Water Quality

While water quality generally looks good there were major problems in the past in getting clean filters and controlling Amoeba and Neglaria problems.

The original mill stream water supply had low pH, high chlorides and high TDS which are usually a bad combination when it comes to pitting corrosion of metals and stainless steel.

With the new dam water supply and the use of gas chlorine, the issues are maintenance of alkalinity, calcium hardness and pH so that the Langlier Index remains in the non-corrosive range. Backwashing must occur properly so that chloride concentration does not exceed 200-250 ppm.

There was a need to install a water meter to the balance tank makeup plus a 50mm diameter make up back to main. It is unclear if this was even undertaken.

There is also a need for LANGLIER INDEX checking of the pool water to ensure that it is not corrosive; this method includes pH, calcium hardness, alkalinity, temperature etc into a Langlier number that can immediately indicate corrosion potential.

Geoff Ninnes Fong & Partners consider it prudent that a high intensity medium pressure UV be installed for advanced oxidation of the water. This would substantially improve water quality.

3.25 In-pool Reticulation

- It has been noted that in January 2006 Dampier Plumping opened up a return line to install a camera and check for leaks. It was noted that the line had dirt etc in it and was poorly laid, not straight. The drawings indicate that the pipe is encased in concrete but it is unknown if this is the case. It is also unusual for the pipe to be a black colour. This is cause for concern as Geoff Ninnes Fong & Partners believe that these lines may reside under the pool as was common with past pools undertaken by the original designer. Dirt could mean that a supply pipe is cracked and dirt is being sucked into the piping.

- Rove Plumbing have retested the system and found general water leakage. Refer to their report which is attached.

3.26 Water Loss

It has been reported that water loss is about 50mm of water from the pool per day which equates to about 21,000 litres/day. This is a substantial amount of water equal to 3x50m pools over a 6 month period.

Evaporation in Roebourne is about 8mm/day in summer and assuming that splash is half this figure of

4mm/day then loss per day from normal causes is 12mm/day or about 1,000,000 litres for 6 months.

Investigation was required to pressure check the flow lines of clean water to the pool at 60Kpa with all floor nozzles screwed shut and plant off. Rowe Plumbing found general pipe leakage (and joint leakage) and about 17,500 litres loss of water per day.

There is a leak through the construction joints which has been dye checked. Construction joints to be replaced.

Regarding sending a camera up the supply lines to see if a leak is visible this has been checked with Rowe Plumbing and due to the pipe diameter and bends this is not feasible.

A makeup water meter should be installed to give a correct reading of water use by the pool itself.

3.27 Results into the Water Treatment and Water Reticulation System

(Investigation of Rowe Plumbing Services)

The following works was requested to be undertaken: -

1. Provide pump curves and information in the pumps
2. Current flow rates from pumps to pool outlet points
3. Pressure test to 60Kpa each return line from gutters to balance tank
4. Inspect each return line with CCTV
5. Pressure test to 60Kpa the pressure lines of filtered water from butterfly valves in plantroom to pool outlets
6. Inspect each flow line with CCTV
7. Identify pumpline locations for flow and return lines
8. Provide estimates

Item 1 & 2 (above)
Flow generally 34l/sec or 122m^3/hr giving a turnover of 3.6 hours

Item 3 (above)
Soiled water return lines held a hydrostatic head from pool gutter to balance tank.

Item 4, 5 & 7
The filtered water lines from the pumps to the line under the pool failed indicating leaks in these lines. The water flow to the pool is discoloured when the floor nozzles were opened so dirt is being sucked into the filtered water lines (item 5 was unable to be done due to all the bends.)

Established water loss from the pool from leakage is 15,750 litres per day which is substantial.

4.0 WATER TREATMENT SYSTEM ANALYSIS AND COMPLIANCE ISSUES

4.1 Introduction

The existing swimming pool was designed in 1992 as a combined lap/leisure pool. Whilst there are no accurate as-built drawings, numerous and significant deviations have been noted from the original tender documents. The facility is operated on a seasonal basis extending from 1st September to the end of May.

The pool is operated at a comparatively high water temperature of 35ºC in summer and 30ºC during the cooler shoulder months. So this is a warm water pool equal to a heated indoor pool at near hydro pool

temperatures. Bather loads have been reported to range from low to moderate. In part, this loading can be attributed due to the large extent of comparatively shallow water.

The key technical details of the existing pool are as follows:-

Pool Surface Area (m^2)	420
Pool Volume (m^3)	440
Design Flow/Plant Capacity (m^3/hr)	112 (34 l/sec) from tests
Pool Turnover Rate (hrs)	3.6 (current W.A. Health minimum requirements 1.5 hours)
Total Filter Area (m^2)	3.0
No Filters/Model No	1 x MHS-125 (MHS3000)
Filter Rate (m^3/hr/m^2)	37
BW Rate (m^3/hr/m^2)	42
Req'd BW Flow (l/sec)	35

As it will be further explained below, the filter's required and mandatory BW flow of 35 l/second is marginally higher than the existing design flow of 34 l/second.

4.2 Treatment Issues

In many regards, the effective treatment of commercial swimming pool water can pose many more complex problems, than those associated with drinking water. In order to best qualify the type of load that a modern pool water treatment (PWT) plant is required to accommodate, it's worth noting that each bather (upon entering the pool) will commonly introduce:-

- One litre of sweat after swimming actively for one hour.
- 50 ml of urine
- 0.5 to 1.0 grams of other organic matter
- 600 million micro-organisms, including 1 to 10 million colon bacteria.

A swimming pool is difficult to treat due to a host of variables that do not exist when conventionally treating water in a single pass. Given that swimming pools provide a captive body of water; swimming pools are subject to a wide range of unique conditions and variable loads.

Apart from the exchange rate from the human body, which is commonly the largest single contributor of load, other significant factors include the pool's water temperature, the existence of wind blow dirt and material, the lack of a smooth pool interior, poor algal control, inadequate chemical dosing, bather management, possible variable quality make-up water, inadequate design, undersized filtration equipment, inadequate turnover rate, deviation from best current practice.

It is unrealistic to expect that a PWT plant will adequately address every conceivable issue and or problem. The majority of dirt load is, after all, carried into the pool primarily by a variable number of patrons who are also carrying various levels of organic matter. Since contamination of swimming pool water is inevitable, it is essential that there be an effective method to treat the pool water and to make it safe for swimmers. This treatment is provided by the operation of three inter-related and interacting systems:

- An effective means of recirculation and mixing of both the dirt load and or any chemicals that are added to the pool for sterilization and or water balance.
- A system for the effective removal of solid particles by filtration.
- An effective chemical dosing program that provides adequate oxidation and safe disinfection residuals.
- Consideration of advanced Oxidation UV to control combined chlorine and pathogens.

4.3 The Recirculation System

The function of a swimming pool recirculation system can probably be best understood if it is thought of as if a transportation system that takes water from the pool to a point where it can be filtered (and chemically treated) to a level, whereby healthy water can be safely returned to the pool. This round trip, is commonly described as "turnover". Turnover is usually expressed as the number of hours necessary to recirculate a volume of water equal to the volume contained within the pool.

Whilst pool turnover is a very important factor, it is only one issue that should be reasonably considered. Other factors such as filter design rates, specific bather loads, standard pollution load, rated pollution load, type of filtration, and the type of process treatment are all equally important. All these issues need to be carefully established by an experienced Designer.

Given that 90% of all pool pollutants occur at or near the pool's surface, the soiled water collection and the distribution of treated/filtered water (within the pool basin) requires very careful design.

Fixed rim skimming devices and wet-deck grating systems (in particular) have proven to be the most effective means of collecting soiled surface water. This method of soiled water removal requires a pool balance tank that is sized to account for freeboard, bather surge, backwash storage, and a suitable reserve that permits an automatic start-up immediately after the backwash cleaning process. In this case the balance tank is considered to be half of the acceptable size.

Bather surge is directly related to the instantaneous load (the maximum number of bathers in the pool at any one time) that is usually established when first designing the system. Subject to design, a backwash supply may be sourced directly from the pool. Although this arrangement requires backwashing outside of normal operating hours, it can substantially reduce the size of the required balance tank. As a guide, balance tanks capacities can vary in size from 5% to 15% of the pool's volume, subject to the design and the selected process treatment. Given the nature of gravity SW (soiled water) lines (supplying the balance tank), the depth of the balance tank is often overlooked as being a critical factor.

Several methods are available for the determination of an appropriate Turnover Rate for a specific pool. The new Health Department Code of Practice Dec-2015 uses a method that categorizes pool types according to some subjective descriptions. On this basis, the most likely classification for the existing pool would be either Category 3 or Category 4 pool requiring a 1 to 1½ hour Turnover Rate.

Other methods for the determination of Turnover Rate are based on water depth. Given that 70% of the pool's surface area provides water of less than one metre deep, it has been assessed (according to Guidelines published by the UK Pool Water Treatment Advisory Group) that the pool would require a 1½ hour Turnover Rate.

Regardless of the method used, the pools existing (albeit theoretical) Turnover Rate of 3.6 hours is substantially greater than required by modern standards and or best practice. As explained below the lack of an appropriate turnover rate is one of the key challenges facing the project. It should however also be noted that WA Health will usually allow a plant designed to an old standard to continue to be used if only the pool structure is being upgraded.

4.4 Filtration Plant

The removal of soiled particles by filtration is a physical/mechanical process. The efficiency of this filtration process is directly related to the function of disinfection by chemical treatment. Whilst the need for disinfection (or sanitization) is commonly understood and accepted, the disinfection process is essentially required for the oxidation process that is necessary to convert numerous “unwanteds” into a filterable form, whereby they can be physically and effectively removed by mechanical filtration.

Despite the relationship between filtration & disinfection, each of these functions makes a quite separate and distinct contribution to the maintenance of a healthy pool environment. To fully comprehend the treatment of swimming pool water such distinctions should be thoroughly understood.

Whilst a filter plant is of some value for its capacity to remove bacteria and disease producing organisms, its primary function, is to remove solids, which if not removed would increase the need for chemical treatment and reduce the germ killing and oxidizing power of the disinfection chemical and or treatment. Filters perform their function of dirt removal through various design methods or combinations of methods.

The most apparent filtration principle is that of a screening process, where dirt particles are separated from the pool water, on the basis that they are too large to pass through the filter media. In addition to this screening mechanism, soil material is also captured in a granular (sand filter) bed by other mechanisms, where gelatinous and mucous-like substances will tend to cling to the grains of filter media.

Filtration efficiency can often be improved with the use of a coagulant, which improves/enhances dirt separation by physical and electrochemical attraction. Properly applied, coagulants can remove turbidity; remove colour, bacteria, algae, taste & odour producing substances. Historically, the most common coagulants for swimming pools have been aluminium sulphate & sodium aluminate. The use of polymer type flocculants (like liquid polyaluminium chloride - PAC) have become common, and are widely considered as being more appropriate than earlier/traditional chemicals. It should be noted that the use of flocculant will never solve a problem with an under-filtered pool. Often such usage of a coagulant will only exacerbate the core problem.

In heated applications, it should be noted that the exchange rate (from the body of bathers) will radically increase as the temperature rises. In these cases, additional filter area, or more precisely, slower filter rates should be considered mandatory. This pool is equivalent to a heated pool or spa, routinely operating with water temperatures (30-35^{O}C) in excess of heated indoor pool temperatures in the metropolitan area (26-31^{O}C).

When making a recommendation on a filter plant the following factors are frequently considered:-

i) the product's service history in similar applications
ii) the number of filter modules required, the amount of plumbing works required, the required backwash flow from each filter module
iii) the product's construction materials and their suitability for the application
iv) the availability of a suitable plant space, the access to the plant areas
v) the pool's system design & process treatment
vi) the amount of filter area required
vii) the ease of operation, the method of backwashing, the wash water consumption, the wash water disposal method, etc.
viii) the degree of operator training required

ix) Life cycle and maintenance costs

x) Energy consumption and maintenance costs.

The performance of the sand filter plant will be broadly governed by its size/capacity and the process efficiency of the particular plant. Plant size is determined by the pool's turnover rate, which is commonly based on pool water depth, pool usage, and the Designer's applied experience. Process efficiency is a function of the filtration type, the use of coagulants (in the case of granular filters) and the filter rate. In the latter case, slower filter rates provide greater filter area for any given plant capacity.

Using the new WA Code, Table 4 implies a maximum daily bather load of either 130 to 147 persons per day. Similarly, the same Table implies a required sand filter area of 12.25m^2 (for a Category 4 pool). Given that the existing filter area is only 3m2, the significance of the current problems cannot be under-estimated. Despite this general water quality is quite good which is a credit to the operators. Recommendation or options will be discussed later in the report together with control of patrons but generally the proposed new filtered water line could be sized for a larger plant for a future filtration upgrade.

4.5 Legislative Requirements

The principal legislation governing the use and the operation of a commercial swimming pool in Western Australia is the Health (Aquatic Facilities) Regulations Code of Practice of Dec-2015.

Apart from the requirements to satisfy any legislative requirements, it should be noted that failure to meet reasonable standards (in the provision of a safe environment for the public and others) can carry heavy penalties. In the unfortunate event of a serious illness or accident, the extent to which the pool Owner & the Operator has adhered to "accepted guidelines" will generally dictate the level of vulnerability to legal action for either negligence and or public liability.

As in the Guidance Notes (provided with Appendix 1) many of the revised and more onerous requirements contained within the old 2007 Regulations, do not necessarily apply to Roebourne Community Aquatic Centre, if the existing facility was previously approved and opened under the old regulations. Some of the operational requirements (as outlined within Sections 5, 6, & 7 of the new Code) did, however, become applicable as from October 1 2007. As a matter of priority, the Owners and the Pool Operators should review the relevant Sections of the new 2015 Code and implement new and appropriate procedures.

Again as noted with Guidance Notice, the Owner/Operators of the centre will have 24 months from the new Code's commencement date to address the requirements of sections, 2.12 (Depth markings), 2.22 (Backwash Water), 2.23 (First Aid facilities), 2.24 (First Aid Equipment) and 2.25 (Rescue Equipment). These aspects have been generally complied with.

<u>It should be noted that WA Health will not usually require the plant to be upgraded.</u>

4.6 Technical Deficiencies (Filtration & Pool Hydraulics)

The system's deficiencies are significant and numerous. The keys issues are as follows:-

i) Whilst the pool's pipe sizing is consistent with the specified design flow (110m^3/hr) the soiled water collection system is unable to sustain this flow. This is evident by the current flooding of the pool gutters and the inability to absorb surge water. Additional take offs are required from the gutter to a separate line running under the concourse to take soiled water to the balance tank via a leaf collection pit.

ii) The actual normal flow and backwash flow has been checked by a pool plumber to establish exactly actual flows. Pumps are currently producing 34 litres/sec.

iii) The backwash tank being elevated can cause polluted water to flow out of the backwash line and contaminate the pool water so this line must be drained after each use. The backwash tank should really be below ground.

iv) The balance tank is too small and a new tank attached to the old is required to give 2-3 times volume. This will assist in filter backwash. Another option is to run a line from the pool to the existing balance tank that is opened when backwash is to commence, to allow instantaneous filling of the balance tank. This would require the backwash when no one is using the pool.

v) Install a UV system to the plant to control chloramines and destroy pathogens.

vi) The return to pool lines are leaking and require replacement and the new pipes should be sized on future plant upgrade and set into the pool floor.

As installed and inspected the existing filtration plant (& its associated reticulation/pool hydraulics) is considered under designed however water appears reasonable in quality. In the short term, we would strongly recommend that the existing filter media be backwashed well and that the chemical treatment be increased to maintain a free-chlorine residual in excess of 2ppm at all times and that the sand be replaced in the filters at least every 2 years. As noted previously WA Health would not require replacement or upgrade of the plant unless loading increases.

4.7 Plant Upgrade Options

A previous report and the resulting designs have produced a new formed and poured fully tiled, concrete, wet deck pool with structure design life of 50 years and tile life of 30 years with correctly sized balance tank and filtration plant that meets all the requirements of the current WA Health Code of Practice.

This pool would have the following.

Long plant life using Chadson sand filters, shunt back wash for excellent cleaning of filters, gas chlorine system for excellent chlorination and a UV system to kill all pathogens and destroy combined chlorine products. Distribution of filtered water was optimised and a long lasting finish to the pool (tiles) was proposed.

The current economic conditions cannot sustain the level of cost required for such a pool and so a relook at the existing pool is occurring to look at viable options to extend the pool life and increase its efficiency of operation.

It is our opinion that the following items of upgrade could be considered bearing in mind that the pool structure is near the end of its design life.

1. The concourse should be relaid so that water falls to concourse drains and then to stormwater

2. The balance tank be rebuilt or extended to a reasonable size that will enable proper and easy back washing of the filters. Another option is to have a separate system of back wash from the pool itself when not in use by patrons

3. The pool interior be removed back to the structure and new external water stops and sealant installed into a recess in the pool structure and continued through the pool gutters

4. Rather than rebuilding the gutters to a correct size install multiple new droppers into an external line that takes soiled water by new pipes to the balance tank via a leaf retention pit

5. Install longitudinal grating on the gutters or build up the outer edge so gutter surface slope is 1-15 towards the pool. Install new edge tiling to the gutters. Re-level the inside lip of the gutter.

6. Excavate out sections of the floor and install new correctly sized and pressure tested filtered water lines and nozzle system all set into new concrete in the pool floor.

7. Re-render the pools with new smooth Chadson render. This has a normal life in a commercial pool of 10-15 years. Algae is more likely to form on pebble joints.

   If a longer life is desired consider mosaic tiles finish which will give a long life and be easy to clean

8. Minor changes to the gas chlorine system as required by Hydramet

9. Install a UV (high intensity medium pressure) to destroy chloramines and pathogens.

10. Plan replacing filter sand every 2 years.

5.0 GAS CHLORINE

GNFP engaged Hydramet to review our photos of the plant and Gas Chlorine Installation.

A summary of their report is as follows:-

i) Chlorination system in good condition.
ii) Manual rate meters in good condition.
iii) Vacuum regulators in good condition.
iv) Heater filter blocks in good condition.
v) Cylinder valves in good condition.
vi) Injectors including throat and tail require urgent replacement.
vii) Leak detector sensors require urgent replacement.
viii) Wind sock required.
ix) Extractor fan in bottle room requires urgent replacement by local electrician.
x) Test button for the shutdown System requires replacement.