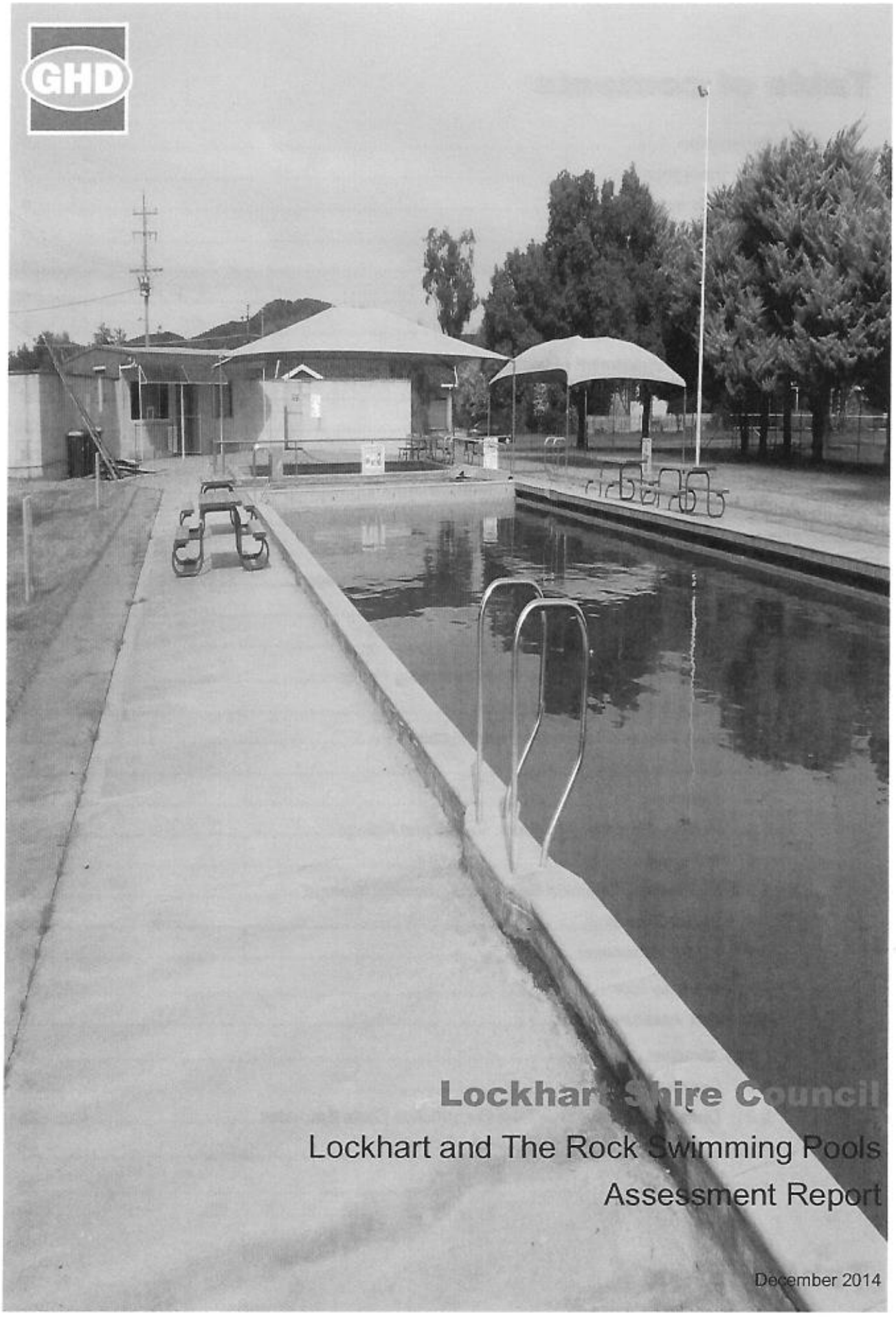


Lockhart Shire Council

Lockhart and The Rock Swimming Pools Assessment Report

December 2014

Table of contents

Table index

Figure index

Appendices

1. Introduction

1.1 Background

GHD has been commissioned by Lockhart Shire Council (LSC) to carry out a general engineering assessment of the Lockhart Swimming Pool and The Rock Swimming Pool, NSW, to identify any infrastructure deficiencies and facility short falls that may impact the performance and asset life of the pools. The works include:

- Site inspection by a Mechanical Engineer to determine the condition of the general pool structure, pool water treatment systems and associated ancillary infrastructure;
- An assessment of the remaining life of the components being determined and their criticality to be replaced based on a comparison with the risk of not replacing or not repairing the identified components;
- Indicative cost estimates that can be used in conjunction with the risk assessment to determine a budget and programme of works to restore the pools, as and if required based on GHD's engineering assessment, and
- Preparation of an assessment report, including risk assessment with indicative repair/replacement cost estimates. The report will be based on the outcomes of the condition assessment and identify any infrastructure deficiencies and facility shortfalls that may impact the performance of the complex and asset life. The report will include recommendations for future remediation works for sustaining capital and/or improvements for consideration by Council.

1.2 Site Investigation

An inspection of the Lockhart Swimming Pool and The Rock Swimming Pool was undertaken on 17 August 2014 and 18 August 2014 by GHD's Daniel Willis (Senior Mechanical Engineer) and was accompanied by Joel Maniscalco (Lockhart Shire Council, Parks and Gardens Ganger). Photo records from the site inspection can be found in Appendix A and Appendix B.

1.3 Supplied Data

There was no data supplied by LSC for the purpose of this condition assessment.

1.4 Report Limitations

GHD's assessment is based on a visual and non-invasive site engineering inspection by a mechanical engineer and may not be exhaustive of all infrastructure deficiencies and facility short falls or other discipline related issues.

1.5 Purpose of this report

This report details the observations and conclusions determined from the general engineering site inspection and assessment for the Lockhart and Rock Swimming Pool and presents preliminary engineering cost estimates to address identified infrastructure deficiencies and facility short falls.

1.6 Scope and limitations

This report: has been prepared by GHD for Lockhart Shire Council and may only be used and relied on by Lockhart Shire Council for the purpose agreed between GHD and the Lockhart Shire Council.

GHD otherwise disclaims responsibility to any person other than Lockhart Shire Council arising in connection with this report. GHD also excludes implied warranties and conditions, to the extent legally permissible.

The services undertaken by GHD in connection with preparing this report were limited to those specifically detailed in the report and are subject to the scope limitations set out in the report.

The opinions, conclusions and any recommendations in this report are based on conditions encountered and information reviewed at the date of preparation of the report. GHD has no responsibility or obligation to update this report to account for events or changes occurring subsequent to the date that the report was prepared.

The opinions, conclusions and any recommendations in this report are based on limitations assumptions made by GHD described in Section 1.4 of this report. GHD disclaims liability arising from any of the assumptions being incorrect.

GHD has prepared the preliminary cost estimates set out in section 5 of this report ("Cost Estimate") using information reasonably available to the GHD employee(s) who prepared this report; and based on assumptions and judgments made by GHD.

The Cost Estimates are preliminary estimates only. Actual prices, costs and other variables may be different to those used to prepare the Cost Estimates and may change. Unless as otherwise specified in this report, no detailed quotation has been obtained for actions identified in this report. GHD does not represent, warrant or guarantee that the works can or will be undertaken at a cost which is the same or less than the Cost Estimate.

The Cost Estimate has been prepared for the purpose of establishing order of magnitude costs to address selective infrastructure deficiencies and facility shortfalls and must not be used for any other purpose. Estimates exclude Engineering, Project Management, Contingency and GST.

2. Engineering Assessment - Lockhart Swimming Pool

2.1 General Description and History

The Lockhart Swimming Pool was original constructed in 1956 and comprises of an outdoor 33 meter pool (formerly a diving pool) and a smaller children's play pool. A new kiosk and amenities building has since been added to the facility.

2.2 Main Pool and Children's Pool Structure

2.2.1 Structure

The main pool is approximately 33m long and 13m wide with a depth grading from 1m at the shallow end to a deep end of 3.1m. The main pool was formerly a dive pool, the diving tower and springboards have subsequently been removed. Access to the pool is via pool step rails. There are two expansion joints that run across the width of the main pool. The expansion joints have been painted over with pool epoxy finish and could not be inspected.

The children's pool is approximately 6m long and 13m wide with a depth grading from 0.4m deep to 0.7m. There is a set of stairs along the width of the pool with three goings which provides access to the children's pool.

Both pools appear to be reasonably water tight noting that the pools have been closed for around 5 months and are holding water with no significant losses.

The condition of the original concrete pool shell is unknown.

Issues that were identified during the site inspection are as follows:

- There are currently no disabled access provisions for either swimming pool. Under the Disability Discrimination Act, disabled access provisions are required to be installed;
- Pool climb out ladders are not code compliant, and
- Starting blocks are not of standard sizing compared with modern pools (typically FINA standard type starting blocks adopted).

2.2.2 Pool Finishes

Both the main pool and the children's pool have an epoxy paint pool finish to the pool floor, walls and pool gutter. Typical design life for epoxy coatings is five to ten years. The pools have a raised pool edging with a red paver finish.

From discussion with LSC, the pools originally had several courses of tiles down the wall and to the top of the soiled water gutter. The tiles were subsequently removed due to age and condition and replaced with the epoxy paint finish.

Issues that were identified during the site inspection are as follows:

- The epoxy paint finish has cracked and appears to have separated from the pool substrate in several locations above the pool water line. It also appears that the substrate was poorly rendered/poorly prepared after removal of the original tiles and has subsequently resulted in a poor aesthetic finish of the epoxy coating. The condition at the epoxy coating below the water line could not be determined due to the low visibility from the stagnant water. The condition of the epoxy finish is considered to be an aesthetic appearance issue / public perception issue rather than a functional issue;

- The red pavers to the top of the pool wall are in varying condition with a number of pavers cracked. Grout between the red pavers is cracked and inconsistent in depth, and
- Generally the facility looks "tired" and aged and lacks visual appeal.

2.2.3 Pool Concourse

The pools have a surrounding concrete concourse with a broom finish. The concourse slopes toward the pool and drains into the soiled water gutters that return water to the pool balance tank. This is unconventional as pool concourses typically drain away from the pool and discharge to stormwater to prevent any contamination on the pool concourse from entering the pool.

Issues that were identified during the site inspection are as follows:

- The concourse drains into the pool soiled water gutters resulting in any concourse contamination entering the pool, and
- The concourse is in poor condition with cracks.

2.2.4 Balance Tank

The pool balance tank is located at the plantroom end of the main pool with the roof of the balance tank forming part of the surrounding pool concourse. The balance tank collects water from the pool soiled water gutters and provides volume for backwashing the pool filters. The inside of the balance tank could not be inspected due to being full of water. An inspection of the drained tank would require confined space entry conditions to be observed.

Issues that were identified during the site inspection are as follows:

- Access covers to the balance tank and trash/leaf screens were corroded and are not lockable to prevent public asses;
- No confined space signage installed onto the access covers as required by AS2865;
- No reduced pressure zone device (RPZD backflow prevention) installed to the automatic makeup water system;
- No water meter installed on automatic makeup water system (typically installed to enable detection/monitoring of pool leakage);
- The balance tank concrete roof has "bony" concrete and a universal beam (I-beam) appears to be retrofitted to support the roof. Further investigation of the structural integrity of the balance tank is warranted;
- Folded sheet metal cover around the pump suction pipework where the pipework rises out of the balance tank is not adequately fastened/ locked to prevent tampering by the public. The cover is corroded and the openings below the cover are a safety hazard if the cover is removed;
- Poor accessibility to remove / clean gutter trash screens (WHS risk), and
- Asbestos board installed to block flow in gutter trash screen (It is recommended that this be replaced with stainless steel and the asbestos board be removed by a licenced contractor).

2.3 Turnover Rates

Pool turnover rates recommended by the NSW Department of Health, Public Swimming Pool and Spa Pool Guidelines, June 1996 and the Australian Standards Handbook HB-241-2002 Water Management for Public Swimming Pools and Spas, are given below in Table 1. As the

main pool and the children's pool are subject to the same water filtration system, they were compared to the guideline period that is closest related to the average depth of the main pool. The current estimated turnover rate for the combined 33 meter pool and children's pool is given for comparison.

- The estimated turnover rate for the combined 33 meter pool and children's pool is estimated to be around 6.5 hours and does not conform to either the NSW or HB241-2002 guideline values.
- Whilst the turnover rate is lower than guideline values, from discussion with the pool operator the filtration system is maintaining water quality during peak demand periods, suggesting that the current turnover rates and filtration system is providing an acceptable level of performance.

Table 1 Combined Multi-Purpose Pool Turnover Rate Comparison Against Relevant Guidelines

Main Pool and Children's Pool	Turnover (hours)	Flowrate (L/s)
Guidelines		
NSW Department of Health, Public Swimming Pool and Spa Pool Guidelines. Multi-Purpose Pool - (Swimming pools > 1.8m but < 2.0m deep)	2.5 hours	90.3 L/s
HB 241-2002 Water Management for Public Swimming Pools and Spas (Standards Australia) - Shallow pools (wading and teaching) up to 1m deep (25m long)	2 - 3 hours	75.3 L/s
Estimated Current Water Turnover	***6.5 hours***	***34.7 L/s***

2.4 Filtration

The main pool and children's pool are served by a common filtration system comprising of a gravity sand filter with two filter cells separated by a backwash outlet channel. There is a floor in the filter which supports the filter nozzles. Below the filter floor is a collection plenum. Water is pumped from the balance tank by the filtration pump into the sand filter. The flowrate into the filter is varied by a float operated butterfly valve on the inlet pipe to the sand filter. The pool water is filtered through approximately 900mm of filter media and assumed gravel bedding before entering the filter plenum via the filter floor nozzles and gravitating back to the pool through the pool circulation system. The outlet pipe of the filter includes a float operated butterfly valve to control the water level in the filter and prevent filter breakthrough of the alum floc.

From discussions with LSC, the filter media was replaced three years ago and appeared to be in good condition. It is typical practice to replace the top 150mm of sand media on a yearly basis to remove any "mud balls" and body fats that have a tendency to build up in the upper layer of the filter media.

The filtration system has been designed for flocculation of the soiled water using aluminium sulphate (alum) for improved filtration efficiency, and is of good practice design.

The filter has been designed for air scour assisted backwash to improve the backwash efficiency. In this process both air and water are used to backwash the filter media and is of good practice design.

The concrete filter appears to be in reasonable condition. It is noted that there was no water in the filters at the time of the inspection to verify the water tightness of the structure.

The condition of the filter nozzles and filter plenum was not able to be inspected.

The total filter area is approximately $10m^2$.

The condition of the pipework cast into the concrete filter walls could not be inspected however it is likely that this pipework is internally corroded and may require replacement. Staining on the pool floor due to corrosion deposits could be an indicator or trigger to upgrade the pipework. It is noted that the filter inlet pipework has been replaced with PVC pipework.

The filtration system is considered to be of high quality, typical of pool filtration systems installed in aquatic centres in that era. Routine maintenance including replacement of filtration media, lubrication of float operated valves (food grade lubricants) with possible upgrade of the cast in pipework should see the continued service from the filtration system.

Issues that were identified during the site inspection are as follows:

- An access ladder has been fitted to enable access to the sand filter. The platform and safety guarding on the access ladder does not comply with AS1657 'Fixed platforms, walkways, stairs and ladders design construction and installation', and requires upgrading to meet statutory code compliance;
- Light fitting installed inside sand filter above top water level is in poor condition and unlikely to be suitable for full submersion should the filter overflow and is a potential electrocution hazard;
- Pipework cast into the concrete filter walls is likely to be internally corroded;
- There is no filter differential pressure gauge or filter level transmitter to indicate filter head loss in order to initiate manual backwash, and
- New soiled water pipe penetration to the filter appears to be leaking with leaching of the concrete evident. An investigation of the leak when the pool is brought back on line could be undertaken to determine if aqua homogeneous healing of the concrete has stopped the leakage.

2.4.1 Cryptosporidium Risks

The children's pool is currently on the same filtration circuit as the multi-purpose pool. Whilst not a statutory code requirement, industry Guidelines typically recommend separate filtration circuits for these types of pools as discussed below:

- The NSW Department of Health, Public Swimming Pool and Spa Pool Guidelines, June 1996 recommends that pools patronised by non-toilet trained toddlers should have a separate circulation system due to risk of outbreak of *Cryptosporidium*, which is introduced through accidental faecal contamination, and
- The "Code of Practice for the Control of Cryptosporidium and Giardia in Swimming Pools, Leisure Pools, Spas and Hydrotherapy Pools" classifies pools with shared filtration and water circulation systems as high risk. The faecal accident/incident policy recommended for all pools by this guideline requires closure of the children's pool and the multi-purpose pool in the event of a stool faecal accident/incident in the children's pool

As a result of the singular filtration system, the following issue has been identified:

- Closure of both children's and multi-purpose pool may be required due to cross contamination in event of faecal accident/incident.

2.5 Pumps, Plantroom Pipework, Valves and Fittings

2.5.1 Circulation Pump

The circulation pump is an end suction back-pull out type pump model DK3551 manufactured by Thomas Kelly and Lewis (TKL) coupled to a RCG 11kW electric motor. The pump appears to pre-date the electric motor suggesting that the motor may have been replaced. The age and internal condition could not be determined on site. Some corrosion is evident on the external casing and coupling guard.

Issues that were identified during the site inspection are as follows:

- The pump set does not have a base plate and has not been installed with adequate support with the motor counter levering off the pump set. This is likely to induce vibration to the pump set, shaft deflection and limit the pump set life;
- It is recommended that the pool filtration pump be replaced with the refurbishment of the plantroom and the current pump kept in storage for redundancy, and
- The pump suction lint strainer is corroded and requires replacing.

2.5.2 Plantroom pipework, valves and fittings

The pipework within the plant room is a combination of new PVC and existing cast iron. The pump foot valve, suction line and sections of the discharge line have been replaced with PVC and are of new condition. The cast iron pipework appears to be in fair condition however it is likely that this pipework is internally corroded and may require future replacement should leakage or carryover of corrosion deposits/rust staining be evident in the pool.

Sluice valves and butterfly valves appear to be in reasonable condition, although LSC advised that some valves are not fully sealing when in the closed position. This could be attributed to foreign objects being caught in the sealing rings or worn out/deformed/damaged valve seats.

Issues that were identified during the site inspection are as follows:

- Valves not sealing are at the end of economic life, and
- Cast iron pipework likely to be internally corroded and at end of economic life.

2.5.3 Air scour blower

The air scour blower appears to be of original installation and is understood to still function sufficiently with uniform bubble distribution across the filter media when backwashing. The discharge pipework with a barometric loop is good engineering practice and prevents flooding of the air scour blower.

Issues that were identified during the site inspection are as follows:

- Guarding for the belt drive should be reviewed against current standards as it appears to be non-compliant, and
- Blower nearing end of service life. Replace at end of serviceable life or on failure.

2.5.4 Miscellaneous

Other items that were inspected or identified as deficiencies in/with the plant room that are not directly associated with the aforementioned components include:

- Pressure gauges on the pump discharge line require replacing and should be positioned on the side of the pipe rather than the top to minimise air entrapment;
- No compound pressure gauge on suction side of filtration pump;

- No differential pressure gauge on the filters;
- No flow meter installed on pump discharge (whilst not necessary for operation, provides indication of filter head loss and optimisation of filtration and backwash flowrate), and
- Building is in poor condition and contains asbestos material. Roofing is corroded, appears to leak and timber box-out for access is dry and splitting. There are holes in the ceiling and walls, windows are broken, downpipes are damaged and paintwork is deteriorating. The structure has reached the end of life and is in need of replacement.

2.6 Backwash

It is understood that backwash water from the sand filters is directed to stormwater. There was no in-ground backwash holding tank identified on site which further supports this.

Issues that were identified during the site inspection are as follows:

- Under the Environmental Protection Act, backwash water is termed regulated waste and is required to be discharged to sewer. This typically requires a backwash holding tank to hold the full volume of water discharged from the backwash process with slow release to sewer at a controlled rate.

2.7 Disinfection, Chemical Dosing and Chemical Storage

2.7.1 Chemical Dosing

Disinfection is achieved by automatic dosing with sodium hypochlorite (liquid chlorine) from portable 15L containers. pH correction is achieved by automatic dosing with hydrochloric acid from portable 15L containers. Alkalinity is adjusted manually by bucket dosing with sodium bicarbonate in the balance tanks.

Aluminium sulphate (alum) solution is batched from dry powder and manually dosed into the pool balance tank. LSC advised that there was no sign of filter breakthrough of the alum floc suggesting that the filtration loading rate is suited to alum flocculation.

The chemical controller utilised for the dosing is a CHEMIGEM water management system model CM55. This model is still in production today and used for public pools, although more advanced water chemistry controllers are available.

The above disinfection and pH correction systems are considered acceptable, although it is unconventional practice to dose from such small chlorine packaging. Handling of portable containers is a WHS risk due to repetitive strain and consideration should be given to installing a bulk sodium hypochlorite storage system or dosing from an IBC.

There is no safety shower located within the plant room where the chemical dosing is undertaken. There was previously provision for a safety shower on the outside wall of the plantroom however this has been removed.

Issues that were identified during the site inspection are as follows:

- Chemical controller may not be interlocked to the filtration system. If this is the case then it is possible for chemical dosing to continue when there is no flow through the pipe. A flow switch should be installed and interlocked to the chemical controller or a more modern chemical controller installed;
- No safety shower and eyewash installed;
- Chemical injection points are not easily removed for servicing;
- Chemical dosing lines poorly supported;

- Chemicals are not bunded and lack of chemical safe trays;
- No MSDS register apparent;
- Aluminium sulphate (alum) dosing should be automated and dosed into the balance tank in the vicinity of the foot valve to suit the filtration flow rate. Typical infrastructure required is a 200L plastic batch tank with a mixer, dosing pump and associated pipework. Concentration and dose rate should be sized to suit the pump filtration rate to optimise the filtration efficiency;
- Sodium hypochlorite and hydrochloric acid is dosed from 15 L containers. This raises concerns with WHS and manual handling, and
- There is no HAZCHEM signage in the proximity of the chemical dosing room.

2.7.2 Chemical Storage

Chemicals are stored in a dedicated chemical store and dosing room. Provision for an emergency safety shower is located outside the chemical store however there is no shower connected.

Liquid pool chlorine is a Class 8 (corrosive) dangerous good. A significant hazard can arise if the liquid chlorine comes into contact with acid as it results in the releasing of a poisonous chlorine gas. The NSW Storage and Handling of Dangerous Goods – Code of Practice 2005 states that if there is more than 1,000 L of pool chlorine stored on site it should be kept a minimum of 5m or separated by a liquid tight wall from other dangerous goods with which it might react. Whilst it is noted that the amount of chlorine stored on site is less than 1,000L it is still recommended that this segregation be adopted.

If the chemical storage of chlorine increased to or above 1,000L it is recommended in the NSW Storage and Handling of Dangerous Goods – Code of Practice that a bund capable of holding at least 25% of the total volume be constructed for 15L containers or in the circumstance that a storage tank is utilised, the bund capacity is to be 110% of the total maximum storage volume.

Issues that were identified during the site inspection are as follows:

- A safety shower and eyewash is required near the plant room and the chemical storage shed;
- Chemical segregation is not present. It is advised at a minimum to store liquid chlorine 5m away from any acids within the same room. Preferably, whilst it is not legislation, it is recommended that liquid chlorine be stored in a separate room to any acids, and
- No chemical spill kit present.

2.8 Water Circulation

2.8.1 Discussion

Both pools share a common water circulation system with filtered water inlets running down the centre of the floor of the pools and surface water draw-off via soiled water gutters that run along opposite lengths of the pools. The water in the pool is intended to be at the same level as the top of the gutters. Water circulates over the edge of the soiled water gutters and drains to the balance tank located underground at the end of the main pool. The water circulation was not observed during this inspection as the pools were not in operation.

The water circulation design is considered of reasonable design and achieves the guideline requirements for a minimum of 75% surface water draw-off with perimeter skimming along at least two opposite sides of the pool, as recommended by the Handbook HB 241-2002 Water

Management for Public Swimming Pools and Spas published by Standards Australia. The following issues are however noted:

- The floor inlet style of nozzle with a vertical discharge does not promote effective mixing of the pool water. Stagnant zones near the base of the pool walls are a likely consequence and require bather movement for effective mixing. This is not easily modified, and
- From discussions with LSC, the top of the gutters are not level along the length of the pool or level on opposing sides. Water leaving the pool takes preference over one site more than the other resulting in "flooding" of one gutter and sections of the top of the gutter being "dry". This would limit the performance and effectiveness of the surface draw off system and appears to be a result of the gutters not being rendered and levelled following removal of the pool tiles and prior to epoxy painting. Shrinkage/swell of the ground resulting in differential settlement at the pool may also be a contributing factor.

2.9 Electrical Services

The facility is provided with a switchgear and control gear assembly in the pool plant room associated with the filtration and treatment process. This assembly is fed from an unknown location. The assembly is in fair condition however no circuit schedule or schematic was noted during the inspection. Capacity of cabling and supplying switchboard was not determined during inspection.

It is recommended that a detailed electrical audit of the system be undertaken by a qualified electrical engineer.

2.9.1 Pool Equipotential Bonding

There are some exposed conductive parts located within the pool zones that, under current standards are required to have equipotential bonding. These include:

- Conductive pit lids;
- Hand rails;
- Marker poles, and
- Lane rope holders.

However the existence of equipotential bonding was not immediately evident. AS/NZS3000:2007 requires that all extraneous electrically conductive parts have equipotential bonding to reduce the likelihood of electric shock. It is recommended that the equipotential bonding of the facility be reviewed in detail and where necessary additional bonding provided and that the installation be tested to ensure code compliance.

3. Engineering Assessment – The Rock Swimming Pool

3.1 General Description and History

The Rock Swimming Pool was constructed around 1971 and comprises of an outdoor 25m pool and a smaller 5.8m children's play pool.

3.2 Main Pool and Children's Pool Structure

3.2.1 Structure

The main pool is approximately 25m long and 9.2m wide with a depth grading from 1m at the shallow end to 1.5m at the deep end.

Access to the pool is via pool steps that have been cast into the pool structure. There is one expansion joint that runs across the width of the main pool.

The children's pool is approximately 6m long and 9.2m wide with a depth grading from 0.25m deep to 0.54m. There is a set of stairs along the width of the pool which provides access to the pool.

Both pools appear to be reasonably water tight noting that the pools have been closed for around 5 months and are holding water with no significant losses.

The condition of the original concrete pool shell is unknown.

Issues that were identified during the site inspection are as follows:

- There are currently no disabled access provisions for either swimming pool. Under the Disability Discrimination Act, disabled access provisions are required to be installed.

3.2.2 Pool Finishes

Both the main pool and the children's pool have an epoxy paint pool finish to the pool floor and walls with several courses of tiles to the top of the walls and a partially tiled pool gutter. The condition the epoxy coating below the water line could not be determined due to the low visibility from the stagnant water. The outside vertical face of the pool coping has been finished with a concrete render and has cracked, possibly due to differential movement between the pool and the concourse.

Issues that were identified during the site inspection are as follows:

- Steps used for exiting the pool have damaged tiling. This may cause slips/falls whilst exiting the pool and aesthetically is not appealing;
- Starting blocks are not of standard sizing compared with modern pools (typically FINA standard type starting blocks adopted), and
- Concrete rendering applied to the outside edge of the pool is cracked. This is an issue with aesthetics rather than structural capacity.

3.2.3 Pool Concourse

The pools have a surrounding concrete concourse with a broom finish. The concourse slopes away from the pool and drains to stormwater. The concourse is in reasonable condition.

Issues that were identified during the site inspection are as follows:

- Differential settlement between the concourse and spoon drain presents a tripping hazard for users, and
- The expansion joints in the concrete have aged and deteriorated.

3.2.4 Balance Tank

Soiled water from the main pool and the children's pool drains into a common balance tank at the plantroom end of the main pool. An internal inspection of the balance tank was not undertaken due to the tank being full of water.

Issues that were identified during the site inspection are as follows:

- Access covers to the balance tank were corroded and not lockable;
- No confined space signage installed to the balance tank access covers as required by AS2865;
- No RPZD installed to makeup water system;
- No flow meter installed on automatic makeup water system, and
- Poor accessibility to remove gutter trash screens (WHS risk).

3.3 Turnover Rates

Pool turnover rates recommended by the NSW Department of Health, Public Swimming Pool and Spa Pool Guidelines, June 1996 and the Australian Standards Handbook HB-241-2002 Water Management for Public Swimming Pools and Spas, are given in Table 2. As the main pool and the children's pool are subject to the same water filtration system, they were compared to the guideline period that is closest related to the average depth of the main pool. The current estimated turnover rate for the combined 25 meter pool and children's pool is given for comparison.

- The estimated turnover rate for the combined 25 meter pool and children's pool is 4 hours and does not conform to either the NSW or HB241-2002 guideline values.
- Whilst the turnover rate is lower than guideline turnover rates, from discussion with the pool operator the filtration system is maintaining water quality during peak demand periods, suggesting that the current turnover rates and filtration system is providing an acceptable level of performance.

Table 2 25m Pool and Children's Turnover Rate Comparison Against Relevant Guidelines

25m Pool and Children's Pool	Turnover (hours)	Flowrate (L/s)
Guidelines		
NSW Department of Health, Public Swimming Pool and Spa Pool Guidelines. Multi-Purpose Pool - (Swimming pools > 1.0m but < 1.5m deep)	1.5 hours	57.1 L/s
HB 241-2002 Water Management for Public Swimming Pools and Spas (Standards Australia) - Shallow pools (wading and teaching) up to 1m deep (25m long)	2 - 3 hours	28.6 L/s
Estimated Current Water Turnover	***4 hours***	***21.4 L/s***

3.4 Filtration

The 25m pool and children's pool is served by a common filtration system comprising of a concrete gravity sand filter, balance tank and filtration pump system. The filter media is approximately 650mm in depth with a total filter area of approximately 6m^2.

As with Lockhart Swimming Pool, the filtration system has been designed for flocculation of the soiled water using aluminium sulphate (alum) for improved filtration efficiency, and is of good practice design.

The concrete filter appears to be structurally sound. It is noted that there was no water in the filters at the time of the inspection.

The condition of the filter nozzles and filter plenum was not able to be inspected.

The condition of the pipework cast into the concrete filter walls is of poor condition.

The filtration system is considered to be of high quality, typical of pool filtration systems installed in aquatic centres in that era.

Issues that were identified during the site inspection are as follows:

- The filter face pipework is in poor condition and requires replacement;
- Routing maintenance including replacement of filtration media, lubrication of float operated valves with possible upgrade of the cast in pipework should see the continued service from the filtration system;
- An access ladder has been fitted to enable access to the sand filter. The platform and safety guarding access ladder does not comply with AS1657 'Fixed platforms, walkways, stairs and ladders design construction and installation', and requires upgrading to meet statutory code compliance, and
- There is no filter differential pressure gauge or filter level transmitter to indicate filter head loss in order to initiate manual backwash.

3.4.1 Cryptosporidium Risks

Similar to the Lockhart pool, the Rock Swimming Pools are currently on the same filtration circuit. Whilst not a statutory code requirement, industry Guidelines typically recommend separate filtration circuits for these types of pools as discussed previously in Section 2.4.1.

3.5 Pumps, Plantroom Pipework, Valves and Fittings

3.5.1 Circulation Pump

The circulation pump is a "Moglide" Harland pump set, model VMB 3 coupled to a 3 HP electric motor. The pump set appears to be of fair to poor condition.

Issues that were identified during the site inspection are as follows:

- The pool filtration pump is of poor condition, and
- The pump suction lint strainer is of poor condition.

3.5.2 Plantroom pipework, valves and fittings

The pipework within the plant room is a combination of new PVC and existing cast iron. The pump foot valve, suction line and sections of the discharge line have been replaced with stainless steel and are of new condition. The cast iron pipework is of very poor condition and is

likely to be internally corroded and should be scheduled for replacement. The pipework is noticeably in worse condition where it passes through the concrete wall into the filters.

Sluice valves and butterfly valves appear to be in poor condition. It was noted that some valves were stiff to move when an attempt to operate them was undertaken.

Issues that were identified during the site inspection are as follows:

- Valves not sealing and of poor condition, and
- Cast iron pipework is internally and externally corroded and at end of economic life.

3.5.3 Air scour blower

The air scour blower appears to be of original installation and is understood to still function sufficiently with uniform bubble distribution across the filter media when backwashing. The discharge pipework with a barometric loop is good engineering practice and prevents flooding of the blower.

Issues that were identified during the site inspection are as follows:

- Blower nearing end of service life. Replace at end of serviceable life or on failure, and
- Blower is located directly under breeze blocks. This may result in adverse weathering of the components and a shortened lifespan.

3.5.4 Miscellaneous

Other items that were inspected or identified as deficiencies in/with the plant room that are not directly associated with the aforementioned components are:

- Pressure gauges on the pump discharge line require replacing and should be positioned on the side of the pipe rather than the top to minimise air entrapment;
- Install pressure gauges on suction side of filtration pump;
- There is no differential pressure gauge on the filters;
- No flow meter installed on pump discharge;
- Window glass has been damaged, and
- Access through roof of plantroom to top of filters is in poor condition and not lockable.

3.6 Backwash

It is understood that backwash water from the sand filters is directed to stormwater. There was no in-ground backwash holding tank identified on site which further supports this.

Issues that were identified during the site inspection are as follows:

- Under the Environmental Protection Act, backwash water is termed regulated waste and is required to be discharged to sewer. This typically requires a backwash holding tank to hold the full volume of water discharged from the backwash process with slow release to sewer at a controlled rate.

3.7 Disinfection, Chemical Dosing and Chemical Storage

3.7.1 Chemical Dosing

The Rock Swimming Pool chemical dosing system is very similar to that of the Lockhart Pool. Sodium hypochlorite (liquid chlorine) and hydrochloric acid are both dosed from portable 15L containers, sodium bicarbonate is bucket dosed at the balance tanks and aluminium sulphate

(alum) solution is batched from dry powder and manually dosed into the pool balance tank. LSC advised that there was no sign of filter breakthrough of the alum floc suggesting that the filtration loading rate is suited to alum flocculation.

As with the Lockhart Swimming Pool, the chemical controller is a CHEMIGEM water management system model CM55. The controller does not operate interlocked to the filtration plant.

The above disinfection and pH correction systems are considered acceptable, although it is unconventional practice to dose from such small chlorine packaging. Handling of portable containers is also a WHS risk due to repetitive strain. Consideration should be given to installing a bulk chlorine storage system or dosing from an IBC.

There was an absence of a safety shower located within the plant room where the chemical dosing is undertaken.

Issues that were identified during the site inspection are as follows:

- Chemical controller may not be interlocked to the filtration system. If this is the case then it is possible for chemical dosing to continue when there is no flow through the pipe;
- No safety shower;
- Chemical injectors are not easily serviced;
- Chemical dosing lines poorly supported;
- Chemicals are not bunded and inadequate chemical safe trays and decanting systems;
- No MSDS register apparent;
- Aluminium sulphate (alum) dosing should be automated and dosed into the balance tank in the vicinity of the foot valve. Typical infrastructure required is a 200L plastic batch tank with a mixer, dosing pump and associated pipework. Concentration and dose rate should be matched to the pump filtration rate to optimise the filtration efficiency;
- Sodium hypochlorite and hydrochloric acid is dosed from 15 L containers. This raises concerns with WHS and manual handling, and
- There is no HAZCHEM signage in the proximity of the chemical dosing room.

3.7.2 Chemical Storage

Chemicals are stored in a dedicated chemical store. There was no safety shower or other safety related equipment present as is standard and it was noted that there seemed to be structural damage to the storage building.

Issues that were identified during the site inspection are as follows:

- A safety shower and eyewash should be installed near the plant room and the chemical storage shed;
- No chemical spill kit present. This in turn could be also used for the plantroom ,and
- Bricks on the side of the chemical storage building near the mesh gate appear to have separated from the building.

3.8 Water Circulation

3.8.1 General

The 25m pool and children's pool share a common water circulation system with filtered water inlets running down the centre of the floor of the pools and surface water draw-off via soiled

water gutters that run along opposite lengths of the pools. The water in the pool is intended to be at the same level as the top of the soiled water gutters. Water circulates over the edge of the soiled water gutters and drains to a deep well located underground at the end of the main pool.

The water circulation design is considered of reasonable design and achieves the guideline requirements for a minimum of 75% surface water draw-off with perimeter skimming along at least two opposite sides of the pool, as recommended by the Handbook HB 241-2002 Water Management for Public Swimming Pools and Spas published by Standards Australia. The water circulation was not observed during this inspection as the pools were not in operation.

- The floor inlet style of nozzle with a vertical discharge does not promote effective mixing of the pool water. Stagnant zones near the base of the pool walls are a likely consequence and require bather movement for effective mixing.

3.9 Electrical Services

The facility is provided with a switchgear and control gear assembly in the pool plant room associated with the filtration and treatment process. This assembly is fed from an unknown location. The assembly is in fair condition however no circuit schedule or schematic was noted during the inspection. Capacity of cabling and supplying switchboard was not determined during inspection.

Issues identified during the inspection included:

- Yellow cabling in the switchboard is not compliant with current standard;
- No differentiation between 3 phase power cabling;
- Switchboard has open wiring without a lockable access door, and
- Switchboard is located beneath breeze blocks as well as the connections are not waterproof.

It is noted that these shortfalls were only picked up on a visual basis and it is recommended that a detailed electrical audit of the system be undertaken by a qualified electrical engineer.

3.9.1 Pool Electrical Earthing and Equipotential Bonding

The existence of equipotential bonding was not immediately evident. AS/NZS3000:2007 requires that all extraneous electrically conductive parts have equipotential bonding to reduce the likelihood of electric shock. It is recommended that the equipotential bonding of the facility be reviewed in detail and where necessary additional bonding provided and that the installation be tested to ensure code compliance.

4. Assessment by Risk

4.1 Risk Assessment

A risk assessment was undertaken on each deficiency observed within the pool facilities. The outcomes of the risk assessments for the Lockhart and The Rock swimming pool facilities can be found in Appendix C and Appendix D respectively. The assessment was based on the risk matrix shown in Table 3.

Table 3 Risk Matrix

Condition	Likelihood				
	Rare	Unlikely	Possible	Likely	Almost Certain
Very Poor	High	High	Extreme	Extreme	Extreme
Poor	Moderate	High	High	Extreme	Extreme
Reasonable	Low	Moderate	High	High	Extreme
Good	Low	Low	Moderate	High	High
Excellent	Low	Low	Moderate	Moderate	High

4.1.1 Condition rating

Condition was rated on a five point scale based on age and condition of the asset. Table 4 provides general guidance on condition ratings.

Table 4 Condition Rating

Condition Status	General Description
Excellent	Infrastructure or element has no defects; condition and appearance are as new.
Good	Infrastructure or element exhibits superficial wear and tear, minor defects, minor signs of deterioration to surface finishes; but does not require major maintenance; no major defects exist.
Reasonable	Infrastructure or element is in average condition; deteriorated surfaces require attention; services are functional, but require attention; backlog maintenance work exists.
Poor	Infrastructure or element has deteriorated badly; serious structural problems; general appearance is poor with eroded protective coatings; elements are defective, services are frequently failing; and significant number of major defects exist.
Very Poor	Infrastructure or element has failed; is not operational and is unfit for occupancy or normal use.

4.1.2 Risk Likelihood

Risk was rated on a 5-point scale for existing defects and non-compliances. Table 5 provides general guidance on risk ratings.

Table 5 Risk Likelihood

Risk Status	General Description
Almost Certain	Failure has occurred or highly likely to fail causing some or all of the asset or element to be non-functional.
Likely	Defects are major and failure is likely to occur, having a significant impact on the functioning of the asset or element.
Possible	Defects are noticeable, many of which are unacceptable. There is a moderate likelihood that further failure will impact on the functioning of the asset or element
Unlikely	Defects are minor and some can be tolerated, but not all. It is unlikely that further failure will affect the functioning of the asset or element
Rare	Defects are minor exhibiting normal wear and tear. It is highly unlikely that failure will affect the functioning of the asset or element

4.1.3 Consequence

Based on the associated risk and likelihood, the defects were then associated with the corresponding consequence. Table 6 provides general guidance on consequence levels.

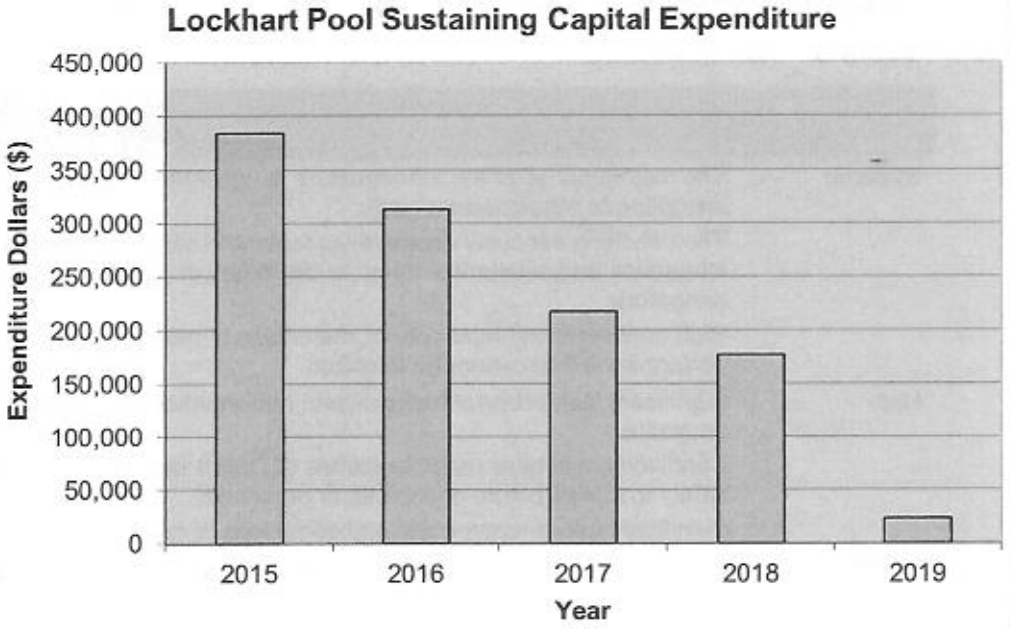
Table 6 Consequence

Consequence Status	General Description
Extreme	The majority or all of the Infrastructure is unusable, causing very significant disruption to Infrastructure users. The condition seriously contravenes legal and safety requirements with an immediate and substantial threat to the safety of personal; work environment is dangerous High consequential repair costs; major loss of revenue resulting from loss of performance that cannot be tolerated.
High	Significant disruption to the functional performance with parts of the Infrastructure unusable. Condition constitutes major breaches of OH&S standard; high risk to health and safety to Infrastructure occupants or personnel. Significant future repair costs and some loss of revenue will result from condition
Moderate	No major loss of service, however some disruption to functional performance that can be tolerated. Condition constitutes minor breaches of OH&S standards with possible risk to health and safety to Infrastructure occupants and personnel. Increased costs are higher as a direct consequence of the building condition.
Low	Little or no loss of service, however minor disruption. No contravention of OH&S & legal requirements. Only minor costs will result from condition. Possible impact to public image.

5. Cost Estimates

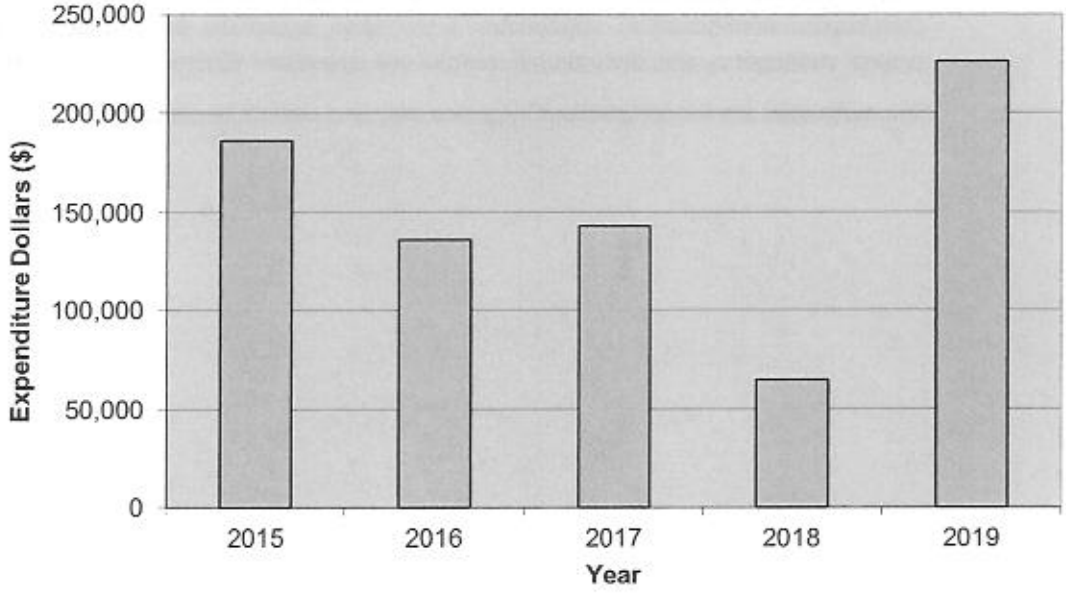
5.1 General

Preliminary order of magnitude cost estimates were established for the Lockhart and The Rock Swimming Pools based on the infrastructure deficiencies that were identified during the inspection. The cost estimates associated with addressing infrastructure deficiencies and facility shortfalls were assigned to a 5 year maintenance/upgrade expenditure program for works to be undertaken based on ongoing judgement in an attempt to distribute expenditure based on priority. These estimates can be found in Appendix C and are summarised below in Figure 1 and Figure 2. The estimates do not include any indexation to account for inflation (CPI/BPI) and are based on year 2014 cost estimates. Estimates exclude engineering, project management, contingency and GST.



Visual assessments were undertaken on the faciliy in August 2014 and may not be exhaustive of all infrastructure deficiences and facility shortfalls. Preliminary order of magnitude cost estimates were established for Lockhart Swimming Pool based on the infrastructure deficiencies that were identified during the inspection. The cost estimates associated with addressing infrastructure deficiencies and facility shortfalls were assigned to a 5 year maintenance/upgrade expenditure program for works to be undertaken based on engineering judgement in an attempt to distribute expenditure based on priority. The estimates do not include any indexation to account for inflation (CPI/BPI) and are based on year 2014 cost estimates. Estimates exclude engineering, project management, contingency and GST.

Figure 1 Lockhart Swimming Pool Programmed Maintenance



Visual assessments were undertaken on the facility in August 2014 and may not be exhaustive of all infrastructure deficiences and facility shortfalls. Preliminary order of magnitude cost estimates were established for The Rock Swimming Pool based on the infrastructure deficiencies that were identified during the inspection. The cost estimates associated with addressing infrastructure deficiencies and facility shortfalls were assigned to a 5 year maintenance/upgrade expenditure program for works to be undertaken based on enginering judgement in an attempt to distribute expenditure based on priority. The estimates do not include any indexation to account for inflation (CPI/BPI) and are based on year 2014 cost estimates. Estimates exclude engineering, project management, contingency and GST.

Figure 2 The Rock Swimming Pool Programmed Maintenance

5.2 Order of Magnitue New Pool Construction Costs Estimates

As part of GHD's commission, LSC has requested GHD provide an order of magnitude costs for construction of a new swimming pool and associated plant and equipment. Based on recent tender pricing, it is estimated that the order of magnitude costs for construction of a new swimming pool is given below in Table 8.

Table 7 Order of Magnitude Pool Construction Cost Estimates

Swimming Pool Size	Order of Cost ($ excluding GST)
50m FINA compliant pool (50m x 8 lane x 2m constant depth)	$5.8M
25m FINA compliant pool (25m x 6 lane x 1m-1.5m deep)	$2.2M

These costs are inclusive of demolition works (for the existing structures), new plant room construction, mechanical plant and filtration construction, concrete pool with provision for structural piling, pool finishes and furniture, electrical works and contractor markup.

It should be noted that these costs are construction costs only and do not include associated project delivery costs including engineering, survey and geotechnical investigations, tendering, construction administration, construction supervision, approvals, stakeholder consultation, project contingency and disruption to normal site operation. Estimates exclude GST.

The estimates are for comparison purposes only and cannot be used for budget setting.

6. Swimming Pools Remaining Life

An assessment of the remaining life of the swimming pools at the component level has been reported in Appendix C and Appendix D. The remaining life assessment is based on the visual and non-invasive engineering site inspections and thus do not include an assessment of internal conditions of pipework, valves, pumps, motors, electrical works, sampling or testing. The remaining life assessment is also based on the assumption that continual general maintenance is undertaken on the facilities on a regular basis and any statutory/code compliance items are addressed.

A more generalised, higher level estimate of the remaining life for the swimming pool elements is provided below in Table 8.

Table 8 Estimated General Remaining Life Range

Component	Lockhart Swimming Pool	The Rock Swimming Pool
Main pool structure	10 – 15 years	10 - 15 years
Filters (concrete structure)	5 – 10 years	5 – 10 years
Plantroom building	0 years	10 – 15 years
Plant room (mechanical & pipework)	0 – 2 years	0 – 2 years
Pool finishes	0 – 2 years	3 – 5 years
Pipework	0 – 5 years	0 – 5 years

1. Notes: General remaining life based on a visual and non-invasive engineering assessment and assumes that continual general maintenance and inspection is undertaken and any statutory/code non-compliance works are addressed, whether identified under this study or by others.

Generally the pool structures appear to be reasonably water tight noting that the pools have been closed for around five (5) months and are holding water with no significant losses.

The major facility shortfalls surrounded the pool finishes, plant rooms and pipework. The pool finishes have a 'tired' appearance. The Lockhart swimming pool finishes have reached the end of life and require renewal. The Rock swimming pool finishes are expected to require renewal within the next five (5) years. The plant rooms were both in a fair to poor condition with the majority of mechanical items nearing the end of their serviceable life.

Whilst some of the pipework has been replaced with PVC, there was evidence that not all pipework had the same treatment. The balance of both in ground and above ground cast iron pipework has reached the end of its life and thus it is not expected that pipework will remain operational for any more than 3 to 5 years.

Typical design life for a pool complex is 50 years. Given that the Lockhart and The Rock swimming pools were constructed in 1956 and 1971 respectively, they are both at the end of the 'typical' design life and require capital injection to extend the life of the assets. This is reflective through the inspection and assessment that has been undertaken by GHD.

7. Summary

GHD has undertaken a general engineering assessment of the Lockhart Swimming Pool and The Rock Swimming Pool and reported on infrastructure deficiencies and facility short falls that may impact the performance and asset life of the facility. The investigation has further assessed the remaining life and risk of not upgrading or replacing the infrastructure deficiencies and reported on indicative cost estimates for the works based on a 5 year works program.

The detailed schedule works can be found in Appendix C and Appendix D.

- Both the Lockhart and The Rock swimming pools are at or nearing the end of their economic life. The Lockhart swimming pool was constructed in 1956 and is 59 years old. The Rock swimming pool was constructed in 1971 and is 44 years old. The typical design life for a swimming pool is 50 years.
- The major infrastructure shortfalls are the pool finishes, plant room mechanical and chemical systems and pipework:
  - The Lockhart swimming pool finishes have reached the end of life and require renewal. The Rock swimming pool finishes are expected to require renewal within the next five (5) years. The pool finishes at both facilities are 'tired' and aged in appearance.
  - The majority of the plantroom mechanical equipment is near the end of the serviceable life and requires replacing.
  - The chemical storage, preparation and dosing systems require upgrading in order to minimise WHS risks and improve operational performance.
  - The majority of in ground and above ground cast iron pipework has reached the end of its life and it is expected that pipework may become problematic in the immediate to short term with possible breakages, reduction in flow capacity and or staining of the pool from corrosion deposits.

7.1 Cost Summary

- Both swimming pools require capital injection to extend the life of the assets. A reasonable life extension would be in the order of 10 to 15 years with capital injection.
  - The total indicative cost estimate for the Lockhart Swimming pool over 5 years is in the order of $1,114,000
  - The total indicative cost estimate for The Rock Swimming pool over 5 years is in the order of $756,000
  - The comparative cost estimate for construction of a new 50m x 8 lane x 2m deep pool is $5,800,000
  - The comparative cost estimate for construction of a new 25m x 6 lane x 1m-to-1.5m deep pool is $2,200,000

7.2 Recommendations

It is suggested the following issues be considered in the near future.

- Code compliance issues identified from the assessment include provision of confined space signage, safety showers and eyewashes, access ladder and openings compliance, out dated or incorrect chemical signage, no backflow prevention installed to makeup water, no earthing of the pool shell, disposal of backwash water to stormwater and no disabled access provisions to pools in accordance with the Disability Discrimination Act.

- It is recommended that the following additional investigations be undertaken:
  - Structural audit of the Lockhart swimming pool balance tank.
  - Electrical audit for both facilities to verify circuit protection, equipotential bonding, emergency exit lighting and zoning compliance with the wiring rules

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Document Status

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