



2019 REVIEW OF WICKHAM AQUATIC CENTRE

for the

CITY of KARRATHA



Revision 0.0
January 25th, 2019
for

Prepared by:



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WICKHAM AQUATIC CENTRE REVIEW

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1.0 EXECUTIVE SUMMARY

BACKGROUND

Wickham Aquatic Centre is a facility constructed approximately 40-50 years ago. The centre has undergone some equipment replacement over this time period – the last partial replacement of some aspects of the water treatment plant occurred in 2006 - however the current condition of most of the finishes and water treatment plant is now considered poor, and subject to risk of potential failure. The centre has a number of safety issues which expose patrons and thus the council to risk. The pool structure has settled in the past, and the structure has been modified to partially accommodate this settlement, although the council has no documentation describing the construction details of the pool, and no as-constructed drawings or design documents.

The facility was the subject of an investigation in 2016 which recommended a series of measures for upgrading. The council has directed that a subset of these recommendations be implemented, subject to the conclusions of the current investigation by Oceanis. The discussed criteria for the current review included planning for the remediation program to deal with the most significant safety issues and continued operation of the pool for a nominal five to ten year period.

The council also included in their direction the inclusion of an upgrade to the capacity of the water treatment plant which was not included as a firm recommendation in the 2016 report and not priced at that time, and which is one of the most significant cost item amongst the 27 directed measures.

CONCLUSIONS

The Oceanis review, based upon our site visit of January 11th 2019, largely supports the majority of the recommendations of the 2016 investigation as minimum requirements for continued basic operation of the centre. A number of additional measures to support and more fully consolidate the remediation project directions are also recommended by Oceanis for safety or operational reasons.

The 2016 report recommendations in many cases seemingly did not consider the ramifications of some recommended measures (the need to remove significant areas of the concourse in order to rectify skimmer and piping being one example), and in other cases seemed to assume that council staff could or would replace equipment with little labour cost implied. Our current review in 2019 also suggests that the budget allowances for tile replacement, grouting and expansion joints should be much larger than were suggested at the time of the 2016 report. The council electrical contractor has identified that the water treatment switchboard is currently at capacity and powering other buildings in an unbalanced manner. In order to achieve the objectives of the directed remediation measures, a replacement of the water treatment switchboard is thus recommended in conjunction with other site electrical upgrading work being conducted by the council.

The combination of the council-directed measures, the consequent measures then arising when the remedial work is more fully examined, and the further recommended measures are identified below as **Remediation Strategy Option 1**. These measures are described more fully in Table 1 and subsequent sections of this report. The notional target budget developed for this strategy (subject to provisos noted below) is nominally \$1,400,000.

While this group of measures would improve the aquatic centre, they would not address all safety and code non-compliance issues. Implementation may still leave the council exposed to

risk of patron injury, water quality deterioration, additional tile failures and the possibility of movement of the structure during the remediation program. Water quality failures particularly could then either result in the forced closure of the pool or significant unbudgeted costs for major remedial works to bring it up to a modern standard which the regulatory authority would require under conditions of such a failure.

Additionally a number of significant risks in the proposed council strategy have been identified and discussed with council staff. In particular the pool structure and concourse levels having moved in the past, many aspects of the pool not complying with current codes and standards, the deep excavation required, and the issues associated with disturbing unknown aspects of the piping and structure leave open the possibility of significant surprises, and consequent costs and delays when demolition and excavation start for the remedial works.

Consequently a strategy for mitigating these risks has been developed and is identified below as **Remediation Strategy Option 2**. This strategy consists of installing a proprietary liner and panel system within the existing structure in addition to the water treatment plant upgrade and addressing all issues identified by the council's directed 27 remediation measures. The notional target budget developed for this Strategy Option 2 (subject to provisos noted below) is nominally \$1,750,000, based upon contractor input.

2.0 ACKNOWLEDGEMENT AND LIMITATIONS

Assistance with this review was provided by Jacqui Harkness and Nancy Milligan of Karratha City Council, Ossie, Rob, and Talia at the Aquatic Centre, Caryn Gore and Richard Theobald at the WA Department of Health, Vince Vucemillo of Hydramet, Greg Clarke of Myrtha, the council's contracted electrical maintenance company, and various equipment suppliers. We thank all for their input and cooperation.

The review has been based upon items of the site, pool and plant related to aquatic issues visible at the time of the review in January 2019, upon information provided by staff at the Aquatic Centre, and information gleaned from the 2016 investigation and the Asset Register produced at that time.

As-constructed or design drawings and specifications are not available for this very old facility. Limited maintenance reports are available from past work or investigations. Water Quality logs provided represent a limited snapshot of conditions. The systems and equipment were not shut down or operationally tested for the review and thus comments are confined to those aspects of the features and water treatment plants which were observed on the day of the site visit.

Target budgets developed represent a comparative indication for the purposes of decision making about the general options to pursue for the remediation of the facility and do not necessarily represent commercial pricing which would be received under specific circumstances of further detailed investigation and design, and of specific commercial conditions at the time of procurement. In particular the unknown state of the structure, ground conditions, hidden piping and other materials, and the nature of any specific contract conditions used will be a consideration of bidding contractors when assessing risk and pricing. Perceptions of risk allocation between client and contractor in the contract documents will be an issue. The small size of the specialised aquatics construction industry in Western Australia and the often variable costs facing contractors working in regional Western Australia are other significant factors facing and which will affect any prices received when procuring the project.

3.0 REMEDIATION STRATEGY OPTIONS

REMEDIATION STRATEGY OPTION 1

Remediation Option Strategy 1 essentially consists of:

- the council directed list of 27 measures,
- consequent actions required as a result of the council-directed measures,
- plus some additional measures recommended as a result of the Oceanis review of the site in January 2019 (if expenditure is approved by the council).

The directed measures are summarised in Table 1 below and are numbered 1 to 27. This table also identifies consequential actions required as a result of these first 27 but which are not fully described by the council brief for remedial works or which were overlooked by the 2016 report. Table 1 also describes an additional group of measures (numbered 32 to 34) which are recommended for implementation for reason of improved operation, safety, risk mitigation or practicality in being conducted at the time of the major remedial works project.

The notional order of cost for a target budget for this collection of remedial measures is \$1,400,000.

This is comprised of nominally \$1,030,000 for council directed items, \$260,000 for consequent issues including the replacement of the concourse and a new water treatment switchboard, \$65,000 for chlorine equipment upgrading to current practice, and approximately \$45,000 for measures intended to improve operational aspects including provision of O&M manuals, As-Constructed drawings, training and providing cleaning equipment.

For the purposes of expediency of the procurement process, in Appendix A to this report is a draft scope of work description of the various measures. Upon direction from the council as to inclusions, this list will be adjusted, further detail may be added this draft scope, and detailed specifications will be developed for the purposes of a tender for procurement

We specifically note that these measures identified as Option 1 are only those initially chosen by the council based upon the 2016 report, consequential items required, and those additional easily correctable issues further identified through Oceanis' site visit of January 11th, 2019. It is important for the council to understand that this collection of measures will not bring the pool up to a modern standard, and will not correct other serious deficiencies in the pool.

We have also specifically identified three significant issues in which the pool contravenes current codes and which leaves the council exposed to risk, and which were only partially addressed by the 2016 report. These issues are:

- The current installation of inappropriate floor tiles in that they are not currently mandated "non-slip" types, with patrons thus subject to slipping in the shallow and steeply graded portions of the pool
- Pool floor grade not in accordance with modern standards in that it has a sudden drop-off contrary to the modern code and good practice
- Inappropriate water distribution (despite the proposed changes proposed by the directed measures) and current very poor water quality which the directed measures will not fully resolve. Oceanis are of the view that the combination of directed water treatment circulation rate and flowrate pattern achieved through use of the single central channel and skimmer boxes will not be adequate even after the remediation measures. Thus the centre may still be subject to poor water quality, and that pool will continue to be at risk of

contraventions of water quality standards, without extraordinary effort on the part of operating staff to maintain the pool.

Discussions with the Health Department of WA (as the regulatory authority governing the above issues) have indicated that as Wickham Aquatic Centre is a legacy pool, (i.e. constructed prior to the implementation of a modern code of practice for aquatic facilities in Western Australia), they will not insist on the council rectifying the above issues. However they have made it clear that should the pool fail a single water quality microbiology test they will issue an order to close the pool until all aspects of the design, construction and operation are brought up to a modern standard. In such a situation the council will have no options but to close the pool and/or spend the funds to re-construct to a modern standard with no leeway provided for any legacy issues. This will be an expensive and time consuming process.

In addition, the very act of draining the pool for the directed remediation work creates additional risk. The changing structural load through removal of the water creates the possibility of movement of the structure. This may lead to further tile delamination and or cracking of the structure and subsequent leakage. The council needs to be prepared for the possibility that in such a case the pool may be out of operation for much longer than intended, and that costs for repair may be much more than desired. There is even the possibility that damage in such a situation could be make it impractical to repair the pool.

The existing pool has a nominal 150 mm diameter supply pipe from the plant room to the pool. This size is marginal for the flowrate required by the directed turnover period of 3.5 hours. The steel pipe is likely to be extensively corroded. While the pipe external to the pool could be replaced in a larger size, the depth of the pool (3+ meters at the deep end) complicates this process) and introduces significant risk in terms of the deep excavation, the unknown state of the structure and how it may respond to such a deep excavation and the unknowns associated with the pipe connections and existing central channel.

REMEDIATION STRATEGY – OPTION 2

To provide the council with a partial mitigation strategy against the risks identified above, Oceanis has reviewed an option for relining the pool while still keeping in place the old existing structure for the sake of expediency in getting the pool back into operation for the 2019/2020 summer season.

This strategy option consists of using a proprietary product (the Myrtha “*renovaction*” system) to apply a stainless steel panel and liner system inside the old structure. This method also allows the implementation of better water distribution within the pool through installation of new sidewall distribution nozzles and new a complete perimeter skimming system (i.e. “wet deck”), which is a significant improvement over the current skimmer box arrangement and single central channel methodology.

This option allows the deep 3+ meter section of the pool formerly used for diving to have a new floor placed in it at approximately 1.8 meters depth, reducing the volume and thus the size of the water treatment plant.

Importantly for risk management during construction, this option would not require excavation to a depth to or below the floor slab level of the existing pool.

Such an option would be much more likely to provide the community with a facility likely to provide service for the ten year horizon identified as a criteria for this review.

This option would include replacement of the water treatment plant in a similar manner to Option 1.

The notional order of cost target budget for this option inclusive of new water treatment plant is \$1,750,000 (subject to the considerations noted above for developing cost targets for this project). Such an option could be implemented in a similar time frame as the proposed minimal remedial measures of Option 1.

4.0 RECOMMENDATION

To satisfy the indicated objectives of this project of reducing risk associated with the current pool and extending the life of the pool by about ten years with reduced risk, Option 2 is clearly the option which must be recommended. However it's cost is expected to be higher than Option 1 by about \$350,000.

Both Options 1 and 2 result in very high costs for a small community, and thus if City of Karratha council directs that a lower budget solution must be arrived, Oceanis will work with council staff to consider and arrive at decisions to prioritise or stage specific measures in the overall remedial works package.

5.0 RECOMMENDED PROCUREMENT STRATEGY

Due to the uncertainty surrounding cost estimates associated with the unknown aspects of the existing pool, the risks the contractors may perceive in such a difficult renovation project, and the highly variable pricing associated with a limited pool of specialised aquatic contractors in Western Australia, as well as the uncertainties associated with making allowances for travel, accommodation and local labour costs in regional Western Australia, determining accurate budgets for the options associated with this project is subject to a wide range of possibilities.

We thus propose a strategy where both major options can be tendered to provide the council with more accurate pricing for decision making purposes.

Tender documents can be prepared for both Options 1 and 2. This will provide a more accurate budget to the council for deciding upon the final contracted pool remediation measures.

Additionally, separate pricing can be requested for separable portions or sub-options (ie. Oceanis recommended additional items for example) thus providing a cost management tool for the project.

This tender documentation process can be prepared in the same time frame as has been discussed for the current commission (nominally February 2019).

For either option, there will be minor changes required to Oceanis consultancy contract for the variations identified by this review for additional items such as structural engineering of the new concourse (included in the target budgets) and the recently identified electrical issue. If the council does choose to proceed with the recommended procurement strategy of pricing both remediation options, there will be additional minor structural engineering fees associated with the provision of a shallower floor in the deep section of the pool and the design for tender purposes of the panel/liner system (allowances has been carried in the target budget numbers).

Oceanis would propose to manage such additions to the consultancy either with in-house resources or by retaining a structural engineer as a variation to our current commission.

6.0 OPTION 1 CONSIDERATIONS

SUMMARY TABLE 1 – OPTION 1 DETAILS AND COMMENTARY

	ORIGINAL COUNCIL DIRECTED MEASURES	OCEANIS REVIEW	NOTES	ANY CONSEQUENT ACTIONS RECOMMENDED FOR SCOPE INCLUSION	RISK
1	Install step delineations	Concur	To be specified as part of pool finish scope Step area tiles are severely degraded, and likely will not survive removal of existing edge tiles	Entire step area risers and treads and side walls of step area recommended to be included in scope; Proposed to be included in target budget allowance; See photos of damage	Adjacent tiles may break or de-adhere during remedial works
2	Replace pool ladder	Concur	To be specified as part of pool finish scope	Requires re-work of concourse slab in area of ladders and handrails	
3	Install Accessible pool hoist	Concur	To be specified as part of pool finish scope	Requires re-work of concourse slab to incorporate hoist footing and water line	
4	Replace cracked tiles at skimmers and in pool lining following water drainage	Concur, however 2016 report allowance is far too small	Two-tile width extent around skimmer mouth as well as skimmer throat as base option Concourse edge tiles are poorly placed and not of modern "fingergrip" design and recommended for replacement Water lines tiles are poorly placed, and recommended for replacement Step area tiles are significantly damaged	In addition to those areas identified, there are significant other damaged areas identified in 2019 and a number of additional tiles to be allowed for underwater tiles and for potential damage during emptying of the pool yet to be determined	Additional tiles may crack or delaminate as part of emptying the pool and removing damaged areas; There is risk in trying to cleanly remove damaged tiles without then also damaging adjacent tiles; The apportioning of this risk between contractor and council will need to be discussed as part of tender document development
5	Renew grouting and silicone joints in the pool	Concur	All tile grout and expansion joints to be replaced		Risk of damaging tiles during removal of old grout and joint material
6	Renew depth markers on concourse and in pool as well as no diving, hazards and vertical depths	Concur	To be specified as part of pool finishing work;		

	ORIGINAL COUNCIL DIRECTED MEASURES	OCEANIS REVIEW	NOTES	ANY CONSEQUENT ACTIONS RECOMMENDED FOR SCOPE INCLUSION	RISK
7	Replace sealant in expansion joints between pool shell and concourse	Concur	To be specified as part of pool finishing work; Concourse will require replacement as a result of Item #9 below	Concourse areas adjacent to the pool will be cut out as part of remedial works for skimmer piping, thus joint sealant will be required	There is a risk that concourse and pool will continue to move
8	Repair slip resistant surface on starting blocks (starting blocks are compliant)	Concur	Can be painted finish (which will need to be re-finished at intervals, but is low cost)		This needs to be a regular maintenance activity
9	Replace and rework skimmers in ground manifolding to even flow and ensure lockable lids	Concur	This will still leave many "dead spots"; Correcting flow through skimmers also does nothing for the problem of poor distribution at depth, which is really only solvable through use of multiple channel distribution of high velocity sidewall distribution	A significant percentage of the concourse will be largely destroyed during this exercise, thus entirety of concrete concourse which is very degraded through cracking is proposed for replacement; If concept of using skimmers is still used, we recommend additional ones (up to 10 more to try to mitigate current "dead" flow locations near surface	This measure will only partially ameliorate the problem of poor water distribution; Also there is a risk that the pool structure will continue to move
10	Replace all floor fittings/water returns, change from 'straight through' style to 'dispersion'	Concur (as a minimum measure, but is not a sufficient)	See notes and risks on item #9 above and #122 below	Flowrate necessary as a result of Item 12 below may mean that centre channel cannot manage additional flow (and documents not available to determine what the centre channel or pipe is constructed	Risk that modern fittings may not be compatible with centre distribution channel, or that flowrate exceeds capability
11	Repair mechanical seal on pump		Pump will be replaced in its entirety as part of Item 12 inclusive of new modern mechanical seal	Increased flowrate needed as a result if Item 12	
12	Ensure pool water turnover time is reduced from 5 hours to 3.5 hours in accordance with Code for Category 7 pool– done through upgrading skimmers, pipework and filters etc.	Do not concur	Oceanis does not concur that 3.5 hour nominal turnover will necessarily solve water quality problems with current centre channel distribution only and skimmer boxes; It is the combination of issues of high water temperature, single centre distribution channel, existing pipe size limiting flow and use of limiting skimmer boxes which all contribute to the risk	See Option 2, which is a measure which will produce better distribution (sidewall high mixing nozzles and complete wet deck); The current piping is nominal 6 inch (old dia steel/CI piping; ≈150 NB); New main header piping ideally will be 200 mm NB for best flow conditions; Distributed RTP nozzles required for best pool	Central channel distribution and limited pipe sizes in connecting to channel may not ever achieve good distribution

	ORIGINAL COUNCIL DIRECTED MEASURES	OCEANIS REVIEW	NOTES	ANY CONSEQUENT ACTIONS RECOMMENDED FOR SCOPE INCLUSION	RISK
				water circulation	
13	Replace sand filters	Concur	Replacement will be part of the water treatment works scope: Budget not allocated in 2016 Report, yet this is the single largest item with significant ramifications	Filters to be increased in capacity for increased flowrate resulting from Item 12 Piping, valving, strainers, etc need updating, and not allowed for in 2016 report Make allowance in target budget for new concrete plinths as part of builder's work, seemingly not taken into account in 2016 report	Pipe disturbance Significant excavation and consequent risk
14	Damage to gel coat and fibreglass, replace with new unit	Concur	Same measure as Item #13 above	"" ""	
15	Use <i>(replacement)</i> of plunge valve for backwashing; replace with face pipework	Concur	Existing filter and header piping and valving will be replaced with new piping, PVC filter face valves (PVC butterfly) and lever or handwheel operators	Piping and filters to be increased in size to account for increased flowrate of Item 12 and to minimise pressure drop to prevent pump motor size from becoming too large for plant room electrical capacity	Existing return-to-pool pipe in ground (potentially at 3+ meters depth, poses significant risk to uncover, excavate and for pool wall support
16	Coating on face pipework & run to pump room deteriorated, replace pipework	Concur	Scope to include protection measure (aluminium pipe jacket normally used and is proposed to be specified in scope of work)	The very original piping within plant room (and likely underground piping is steel or cast iron; This will extensively corrode internally and is strongly recommended for complete replacement; This seemingly was not within 2016 estimate but will need to be included within target budget development	The underground piping is a major risk for the facility both in terms of any remaining useful lifetime, but also in terms of risk to pool walls when excavating
17	Install new ventilation to chlorine room and pump room	Concur	The chlorine store room seemingly has had a new extraction fan installed; However the discharge point does not comply with AS2927	Re-work Chlorine store room ventilation; Provide entire new plant room ventilation system	
18	Replace all fittings, fasteners and brackets	Concur	This will be done to a modern standard as part of the measures associated with Item 12 (including new piping and all its required supports)	Insufficient allowance in 2016 report	
19	Ensure all items RCD protected	Concur, However	This will be part of scope of remediation works as well as	Insufficient allowance in 2016 report;	Existing metallic fittings in the

	ORIGINAL COUNCIL DIRECTED MEASURES	OCEANIS REVIEW	NOTES	ANY CONSEQUENT ACTIONS RECOMMENDED FOR SCOPE INCLUSION	RISK
	and electrical bonding is to standard	it may not be practical in all cases	aspects of pool works (i.e. new ladders) required to be grounded; However existing items may not be practical to bring into line with modern standard	Any attempt to ground lane rope anchors (for example) will likely damage tiles and structure.	pool are likely not grounded (being a 50 year old installation); It may not be practical to provide grounding to items like lane rope anchors without damaging the pool and finishes
20	Relocate isolators and junction boxes (items underneath potential waterline in pit not appropriately IP rated)	Concur	This will be done as part of major water treatment works upgrade resulting from Item 12	All new devices requiring power and controls and/or relocated will need to re-wired as part of overall water treatment works; Likely more practical to replace switchboard as a result of Items 12, 19 & 20 than to try to modify; Insufficient allowance in 2016 report	
21	Replace corroded baseplate on filtration pump and repair housing corrosion	Concur	Pump and base will be replaced as part of Item #12 and 22		
22	Replace filtration pump	Concur	This will be replaced as part of Item #12	The intake strainer basket will need to be replaced to coordinate with new pump; Valving and instrumentation on intake and discharge side of pump will need to be replaced as part of the process; The above appears not to have been accounted for in 2016 budget	
23	Replace Chlorine Circulation pump	Concur	This will be done as part of overall water treatment works upgrade		
24	Dosing pump-check valve used as loading valve, replace with loading valve	Concur	This will be done as part of overall water treatment works upgrade		
25	Sump pump replacement	Concur	This will be done as part of overall water treatment works upgrade		

	ORIGINAL COUNCIL DIRECTED MEASURES	OCEANIS REVIEW	NOTES	ANY CONSEQUENT ACTIONS RECOMMENDED FOR SCOPE INCLUSION	RISK
26	Replace chemical controller	Concur	This will be done as part of overall water treatment works upgrade	Seemingly only \$750 allowed in 2016 Capital Works Table??	
27	Reinforce chlorine injector valve to wall for support- currently limited support	Concur	This will be done as part of overall water treatment works upgrade		
ADDITIONAL MEASURES RECOMMENDED (NOT ADDRESSED IN 2016 REPORT or NOT PART OF CoK DIRECTED SCOPE)					
	ORIGINAL COUNCIL DIRECTED MEASURES	OCEANIS REVIEW	NOTES	ANY CONSEQUENT ACTIONS RECOMMENDED FOR SCOPE INCLUSION	RISK
28	Chlorine system upgrading: <ul style="list-style-type: none"> - Modern Halogen electric safety shutdown in lieu of current pneumatic - Upgrade injector pipe and valves to schedule 80 - Install Schedule 80 manifold and isolation valves for regulators - Install heater drip legs to regulators - Install new modern gas alarm dialler - Replace injector associated components - Install new carbon columns - Major service on all chemistry components 		Chlorine gas use is a major risk for the facility, and Oceanis recommends that all aspects be brought up to modern standard as recommended by service providers working in this specialty field; These measures recommended by Hydramet – service agents to the centre for chemistry aspects	These measures are recommended to be conducted at the same time as Item 12 to effectively produce a renewal of the entire water treatment system.	Appropriate management of chlorine gas is the single largest OH&S risk to staff, and potentially to patrons
29	Upgrade of Switchboard in water treatment plant room to allow all new interlocks and safeties to be provided for Water Treatment plant		Current switchboard has had capacity extended for multiple non-Water Treatment uses, and is over-extended, phases are currently unbalanced, and the board currently will not cater for the increased electrical load required by Item 12 (3.5 hour turnover), as indicated by January 21 st , 2019 electrical report;	The entire site should have its distribution redesigned as part of the other upgrade measures at the recreation site; A new water treatment switchboard, inclusive of controls is proposed to suit the varied pump sizing and new water chemistry controls	Electrical distribution across the entire site needs planning, and water treatment services should be isolated for risk mitigation
30	Concourse concrete is extensively cracked and degraded; It would appear that stormwater drainage off the concourse is not catered for with seeming low points immediately adjacent to the change room doors and lifeguard room;		The replacement of new skimmers, skimmer piping, and ladders will require a significant percentage of the concourse to be cut and replaced; We recommend replacing the entirety to start afresh with a non-cracked concourse and to plan for	The concourse replacement could be made part of the pool scope of works, or could potentially be included within the builder's works for the amenity building	Cracked edges could be a public hazard

	ORIGINAL COUNCIL DIRECTED MEASURES	OCEANIS REVIEW	NOTES	ANY CONSEQUENT ACTIONS RECOMMENDED FOR SCOPE INCLUSION	RISK
	Cracking was identified in 2016 report, but not directed as part of the		stormwater drainage management		
31	Facility operators to be provided with new cleaning equipment including robotic cleaner		The pool is overloaded with algae and must be cleaned more regularly. Electrical outlets need to be positioned for easy cleaner use	New electrical outlets required to provide power for vacuum cleaner and/or robot cleaner	There is a very high risk with current algae laden pool
32	Training should be provided for new water treatment plant, and pool operation to maintain correct chemistry parameter and minimise biological risks		Currently the pool has extensive visible algae growth, which is very often associated with other microbiological risks	Training with new equipment should be mandatory and refresher training should also be conducted by the council periodically	
33	O&M manuals and as-constructed drawings recommended to be provided for new works		The lack of records has made the remedial process more expensive than it might otherwise have been and introduced uncertainties into what will be revealed when the work is implemented	The current centre lacks O&M manuals and as-constructed drawings, which is now resulting in cost to the council in terms of unknown aspects of items requiring maintenance	Council should make every effort to maintain records for future maintenance purposes
34	Potential for disruption to structure and finishes and consequent extra work when excavating for new piping installation and when pool is emptied		Seemingly not addressed in 2016 report	Council to be aware of potential for disruption to pool structure when emptying and remedial works occur	If risk placed against contractor this may be reflected in increased pricing or reduced tender interest

Other issues which in part have been identified in the 2016 report which make the pool non-conforming with the current codes are:

- Floor grade at drop-off to deep end is not in accordance with standards and is a risk to patron, and thus to the council
- Floor tiles are gloss finish rather than non-slip, and thus create a risk for patrons, and thus to the council.

Discussions with the Health Department of WA indicated that despite the major upgrade proposed, as a legacy facility, they would not necessarily enforce an upgrade to all aspects of the centre to the current code requirements. However they made it quite clear, that the council was at risk in terms that a single poor microbiology result would lead to an order from the department to shut down the facility until all aspects of the facility were brought up to code. This includes all legacy issues such as the two issues on floor finish and floor grades noted above.

Additionally very high risk is associated with the connection of new piping to the existing pool in terms of depth of excavation, possible failure of existing structures, possible failures of piping at connection points at and in the pool centre channel, and the general unknown condition of the pool structure and piping system.

7.0 OPTION 2 CONSIDERATIONS

Remediation Strategy Option 2 scope would consist of:

GENERAL DESCRIPTION

- Provision of a new panel and PVC liner system within the existing pool structure
- Constructing a new pool floor inside the deep section of the existing pool to create a shallower area and reduce necessary treated volume
- Provision of a new wet deck around the entire perimeter of the pool to improve skimming and circulation in all parts of the pool
- Replacement of pool furniture (handrails, ladders, lane anchors) including code required earthing of all metallic elements
- Replacement of water treatment plant to achieve minimum code mandated turnover requirements, including construction of a new balance tank
- Replacement of the pool concourse with new brushed concrete finish, exposed aggregate or prefabricated paving materials.
- Minor items and improvements as discussed for Option 1.

SPECIFIC INCLUSIONS

1. Remove existing concrete concourse
2. Cut off the existing top of the pool wall (old scum gutter construction) and remove of existing skimmer boxes
3. Fill in deepest portion of pool (currently at nominally 3+ meter water depth) to achieve nominally 1.8 meters depth at the deep end in the refurbished pool and install a new reinforced concrete floor within the existing structure
4. Remove existing tiles as necessary to install Myrtha Renovaction System
5. Install new Myrtha Renovaction System inclusive of:
 - a. A complete perimeter skimming system (wet deck) around the entire pool including stepped access areas
 - b. Screeding and levelling the existing pool floor as necessary
 - c. Installing a floor liner system (PVC) with a non-slip floor texture
 - d. Installing wall stainless steel / PVC panel system
 - e. Installing sidewall distribution nozzles
 - f. Providing equipotential bonding for all metallic components of the revised pool
 - g. Installing new water line tiles, perimeter finger grip tiles and step non-slip

6. Install new step handrails at the two stepped entries and ladder access to the pool in four locations, all in stainless steel
7. Install return-to-pool piping of an adequate size to achieved design turnover rates
8. Install balance tank return piping from the gutters to a new balance tank
9. Construct new balance tank within the filter compound
10. Install new filtration and piping system within the filter compound, sized to achieve not less than 3.5 hours turnover and good circulation through all parts of the pool
11. Install new PVC piping between the plant room and the pool, inclusive of supply to sidewall return nozzles and balance tank return piping connections from the pool wet deck gutter
12. Install new pumping and water chemistry equipment within the existing plant room in order to achieve Code of Practice mandated flowrate (3.5 Hour turnover)
13. Install a new electrical panel, and coordinating the electrical supply with the electrical design being conducted for other projects on the site
14. Provide equipotential bonding to all metallic components associated with the pool
15. Install residual current device protection to all electrical circuits
16. Replace the existing cracked concrete concourse with a new concourse constructed in either brushed concrete finish or prefabricated pavers, finished with a non-slip surface
17. Install universal access hoist
18. Resurface existing dive blocks or install new dive blocks in conjunction with pool panel and gutter system
19. Update chlorine and chemical use installation inclusive of:
 - a. Halogen electric safety shutdown in lieu of current pneumatic
 - b. injector pipe and valves revised to schedule 80
 - c. Schedule 80 manifold and isolation valves for regulators
 - d. heater drip legs to regulators
 - e. new gas alarm dialler
 - f. injector associated components
 - g. new carbon columns
 - h. chlorine circulation pump
 - i. chemical controller
 - j. injector valve support
 - k. Major service on all chemistry components
20. New sump pump package for pump well
21. Improved ventilation in plant room

8.0 CURRENT SITUATION

Oceanis has reviewed the aquatic centre on and considered subsequent information provided by the council and contractors.

The information included below is based on the site visit by Oceanis (January 11th, 2019), operations and maintenance data provided by City of Karratha operations personnel, previous report prepared by pool contractors as provided by the City of Karratha and maintenance and cost estimates provided by equipment providers and services systems contractors.

The following items in this section are our evaluation of the specific scope items included within the commission, and also include additional items recommended for inclusion in the project.

1 Pool Entry Step Delineation

The steps will be provided with the necessary colour delineated tiles. Consequent damage to adjacent tiles is very difficult to avoid in such a situation.

2 Pool Ladders

Some corrosion has been observed. As part of the overall refurbishment, the recommended scope measure to replace ladders is supported. The Scope of work will thus be developed on the basis of providing annealed type 316 stainless steel ladders nominally to match dimensions of current ladders.

3 Accessible Pool Hoist

A pool hoist for access by can be provided at near the change room shallow end. Hydraulic connection needed for operation. The water supply to be provided via piping from either the change room or the water treatment plant roo, consequently the concourse will need to be cut and re-instated for both the piping and the hoist foundation.

4 Cracked Tiles at skimmer / Other Locations

Cracked, broken or delaminated tiles were found at various locations or are recommended as follows:

- Around skimmers; Recommend minimum two tile width wall tiles surrounding skimmer opening plus inside skimmer throat be allowed for;
- Additional skimmers will be required for increased flowrate, and alleviating deadspots; Allow ten such locations;
- Edge tiles; Cracked, displaced, and not in accordance with modern practice of full finger grip safety approach; Recommend all such tiles be replaced;
- Water line tiles: These are damaged or have had replacement tiles poorly placed in the past; Recommend that all such tiles be replaced;
- Step edge tiles: Recommend that these be replaced as directed with colour delineation;
- Steps: the edge tile replacement process above will almost certainly result in damage to the step tiles themselves: Recommend that the entire step area be re-tiled;
- Step area wall tiles: These are extensively damaged; Recommend that these are replaced in their entirety;

- Occasional other floor and wall tiles appear damaged, and may be revealed to need replacement when the water is removed from the pool;
- Additionally the process of removing water, may create stresses which dislodge further tiles; While such dislodgement is not predictable, an allowance should be made for such occurrences; In the absence of a detailed investigation, draining the pool, or sufficient pool shutdown time to drain and review prior to ordering tiles, it is suggested that 10% of floor and wall tiles be allowed for: This is approximately 50 m² of tiled area.

Note that the 2016 Asset Register Capital Works Table only allowed for a very minor amount of tile replacement, and did not seem to allow any time, travel costs or accommodation for experienced pool tilers to travel to Wickham to actually do the work, or for transport costs for tiles and associated materials. There also is no allowance for any other damage to tiles, which will almost certainly occur as the water is removed from the pool and identified damaged tiles are removed.

5 Tile Grouting / Silicon joints

The tile grouting and tile expansion joints can be replaced entirely. This is a notional six week project (weather and contractor resources dependant).

6 Depth Markers / Signage

Depth tile markers will be used on horizontal and vertical faces as per HDWA Code of Practice

7 Joints between Pool Shell and Concourse

The sealant between the pool shell and the concourse will be replaced. It is noted that in the environmental conditions of Wickham with extreme temperature changes, materials will both expand and shrink, and deteriorate over time. Both of these issues will significantly impact any sealant material, and as a result, the joint seal will need regular maintenance or replacement.

8 Starting Block Surfaces

The recommendation to replace the non-slip surface finish of the dive blocks is supported and can be provided via a paint finish. This application as well will require regular maintenance.

9 Piping Connections from Skimmers to Plant Room

We concur that new manifolded, large diameter piping will be required from the skimmers to the plant room in order to accommodate the flow required by a Category 7 pool. Additional skimmers will also be required in an attempt to mitigate some of the current “dead” spots in the pool. This requires additional piping, likely in the form of a ring main around the pool. Significant areas of the concourse will be required to be cut out and re-instated, at significant cost. Thus, we suggest that the entirety of the concourse be removed and reinstated as part of this project.

Skimmer designs are not as efficient as wet deck designs for warm, heavily loaded pools.

10 Return-To-Pool Fittings

The style of floor return-to-pool fitting can be changed to a floor dispersion type. This measure has several risks, including that the central channel size may be inadequate for the flow now required, that the new nozzles may not easily mate with the centre channel and that tiles may be damaged in the process of replacing nozzles. Additionally the fundamental

premise of a single row of nozzles in this size of pool is questionable. Modern design for warm heavily loaded pools would have closer spaced nozzles.

11 Pump Mechanical Seal

In order to achieve the specified flowrate, the pump will be replaced in its entirety. The new pump will be specified with a mechanical seal.

12 Pool Turnover Time

The design of the new pool water treatment system and hydraulics will provide for the specified 3.5 hour turnover. This will require replacement of pump, filters, Return-to-Pool piping and soiled water piping and increased electrical capacity.

13 Filters

The pool filters do show the surface degradation mentioned in the 2016 report, and the proposal to replace filters is supported.

14 Filter Surface Coating

Same as Item 13 above.

15 Filter Valve Arrangement

Associated with the replacement of the filters, the recommended measure to re-pipe the filters with face piping and valving for management of backwash and rinse cycles is supported.

16 Piping Replacement

Associated with the replacement of the filters, the recommended measure to replace the interconnecting piping is supported. It is noted that some of the piping visible in the plant room is old steel or cast iron piping, and is expected to be seriously corroded in the aquatic centre environment. It is expected that underground piping may be similar.

17 Chlorine Store Room Ventilation

The exhaust fan appears to have been replaced relatively recently. However the discharge downward is not in accordance with code requirements.

The plant room will be specified to have installed a wall mounted fan blowing into the lower pump pit area, and an exhaust fan at high level.

18 Fittings, Fasteners and Brackets

Associated with the replacement of the majority of the water treatment plant, the recommended measure to replace the fastenings, fittings and brackets is supported. Proposed to be used are poly pipe clip brackets and unistrut supports

19 RCD Protection / Earthing

All electrical circuits are to be provided with residual current device protection in accordance with codes. This is required to be implemented in the remedial works, and will be part of the scope for the renewal of the electrical work associated with the water treatment plant.

All metal items near the pool are to be grounded in accordance with code requirements.

Note that it may be difficult and expensive to ground items such as lane rope anchors without damaging the tiles and structure. This issue needs to be investigated further and worked into the cost estimates for procurement.

20 Relocate Electrical Items in Pit

This recommended measure is supported and will become part of the scope of work.

21 Pump Baseplate

As part of the replacement of the pump, a new base mounting arrangement will be provided. This is recommended to be a concrete base (nominally 150 mm high) with the metal base bolted to this via rubber vibration isolators.

22 Filtration Pump

The pump will be replaced as part of achieving the improved flowrate. System design will look for the optimum sizing and pump curve to achieve high efficiency operation, and will be specified in the procurement documents. The pump materials considered will be cast iron with a lining, bronze and FRP, and a selection made on quality versus cost.

23 Chlorine Carrier Water Pump

This recommended measure to replace this pump is supported and will become part of the scope of work.

Interlocks between the main circulation and chlorine injection pump will be provided.

24 Dosing Pump Associated Elements

This recommended measure to replace the loading valve is supported and will become part of the scope of work.

25 Sump Pump

This recommended measure to replace this pump is supported and will become part of the scope of work. Standard economical packages are available for duty and standby dual pump arrangements.

26 Chemical Controller

This recommended measure to replace the chemical controller is supported and will become part of the scope of work. Note that the 2016 report did not allow sufficient funds for this item.

27 Chlorine Injector

This recommended measure to properly fix this piece of equipment is supported and will become part of the scope of work.

28 Additional Item 1 – Chlorine Related Upgrades

Hydramet have recommended an upgrade to current equipment and practice as detailed in Table 1 of this report.

29 Additional Item 2 – Water Treatment System Electrical Switchboard

The Council contracted electrician was able to measure loads and found the board to be unbalanced between phases. The new increased pump size will put additional load on this switchboard. Subsequent to its initial installation, clearly extra items in other buildings have been connected to the board, such that it no longer serves just the water treatment plant.

We recommend that a new dedicated switchboard be installed which serves only the water treatment plant. We also recommend that the council takes a coordinated approach to designing all electrical services on the site, inclusive of renovation to other buildings.

30 Additional Item3 - Concourse

The existing concourse is significantly cracked. The remedial works associated with skimmers and piping will require significant areas of the concourse to be cut, removed and replaced. Rather than then having issues associated with mating two different surfaces of different age and quality, we recommend removal of the entire concrete concourse and reinstatement in a new design.

31 Additional Item 4 – Cleaning Tools

At the time of our site visit the pool was extremely heavily loaded with algae. This situation was also reported in the 2016 report.

We recommend that the aquatic facility be provided with both manual and automatic cleaning equipment (robot cleaner for night use). While this equipment could be purchased through other means, the remedial works project should provide weatherproof electrical outlets in suitable positions to suit the equipment cable lengths proposed.

32 Additional Item 5 – Training

Associated with the new equipment being installed council staff should be provided with training in its operation and maintenance.

33 Additional Item 6 - Operating & Maintenance Manual

Hydramet have recommended an upgrade to current equipment and practice as detailed in Table 1 of this report.

34 Additional Item 7 – Structure Movement Issue

The attempt to remediate the existing pool has every possibility of doing more damage when the pool is emptied, or when excavation is conducted. With no existing design or construction information and soil loading condition unknown, this is a significant risk, unable to be quantified.

APPENDIX A – REMEDIATION MEASURE DRAFT SCOPE – OPTION 1

Remediation Strategy Option 1 scope recommended for council consideration is the following:

GENERAL DESCRIPTION

- General repair and/or replacement of finishes and pool furniture including replacement of damaged and inappropriate tiles
- Replacement of pool tile grout and expansion joint material
- Increase pool water treatment system to a minimum of a 3.5 hour turnover
- Revise pool piping for improved circulation
- Various water treatment plant upgrade measures
- Consequent remedial works arising as a result of the minimum remedial works actions directed.

SPECIFIC INCLUSIONS

1. Install Step delineation tiles (inclusive of replacing all adjacent tiles damaged in the process)
2. Replace pool entry handrails and ladders (inclusive of new concrete anchors placed into the concourse, and refinishing of concourse area damaged in the process)
3. Install accessible pool hoist (inclusive of new concrete footing placed into the concourse, water line to hoist location, channel cut for water line and refinishing of concourse area damaged in the process)
4. Replace cracked tiles in multiple locations inclusive of:
 - a. Around skimmers; Minimum two tile width wall tiles surrounding skimmer opening plus inside skimmer throat;
 - b. Tiling for additional skimmers which will be required for increased system flowrate, and for alleviating deadspots in the pool; Allow ten such locations;
 - c. Edge tiles (fingergrip) around the entire perimeter of the pool; Cracked,
 - d. Water line tiles around the entire perimeter of the pool: ;
 - e. Step edge tiles: Recommend that these be replaced as directed with colour delineation;
 - f. Steps: the edge tile replacement process above will almost certainly result in damage to the step tiles themselves: Recommend that the entire step area be re-tiled;
 - g. Step area wall tiles
 - h. Other floor and wall tiles as are revealed when the pool is emptied of water; Additional tiles to be ordered in initial contract; Unit rates to be solicited for additional work
 - i. Tiles damaged in the process of removing water and remediating the pool; Pricing to be solicited for various quantities and tiles being ordered in advance and unit rates solicited for additional work
5. Replace all tile grout and all tile expansion joints
6. Replace depth markers on concourse

7. Replace sealant in movement joint between pool shell and concourse (subject to concourse design and repair)
8. Refinish slip resistant finish on dive blocks with a non-slip paint finish
9. Replace all existing skimmers (10); Provide new skimmers at locations directed to improve upon pool circulation (10 locations); Excavate around perimeter of pool (including removal of concourse slab), place new 200 mm diameter gravity flow piping ring main for connection of soiled water back to plant room; Replace concourse slab with new brushed finish concrete inclusive of tied connection to existing slab, sealant joints and drainage provisions
10. Replace pool floor inlet fittings (24) with side flow dispersion models; Make contingency provisions for inadequate centre channel connection for new nozzles; Sample nozzle to be placed initially and reviewed with the superintendent
11. Newly selected main circulation pump, with mechanical seal
12. Provide minimum 3.5 hour turnover water treatment plant capacity inclusive of:
 - a. New piping (Class 12 PVC) sized for low pressure drop and minimum power load on existing site electrical system
 - b. New valves, fittings and instrumentation
 - c. New pump to suit flowrate and pressure drop of installed piping and nozzle system
 - d. New filters (3) piped for shunt backwash and gear drive face valves
 - e. Connections for water chemistry monitoring and dosing
 - f. Upgrading of the electrical switchboard, controls and all other electrical equipment
13. New water chemistry components complete with gear drive face valves, drainage and venting provisions;
14. Coordinate filter and the remainder of the plant installation with shade structures being procured separately by the City of Karratha
15. New filters shall use face piping valves complete with gear drive operators
16. All external piping shall be protected with aluminium sheeting
17. Chlorine storage room ventilation shall be revised to modern practice and code requirement including vertical discharge of exhaust outlet to provide dispersion of vapours away from occupants; Provide new ventilation of plant room inclusive of wall mounted propeller fan blowing into low level pit area, and high level wall or roof mounted fan exhausting air from the plant room
18. All piping and equipment bracketing and fixings to be replaced with plastic and FRP/stainless unistrut and non-metallic bracketing
19. All electrical circuits serving the plant room are to be RCD protected; All metallic components associated with the pool and water treatment plant are to earthed; Provide separate pricing for in-pool elements not being revised as part of this remedial works package (largely, lane rope anchors)
20. All electrical components within current pump pit are to be relocated above any potential flood line in this low level of the plant room (except for pump motor)
21. As part of Item 12 the pump base will be replaced; Provide new concrete plinth of minimum 150 mm height to suit the new pump

- 22.The Filtration pump will be replaced and is to be selected to suit the directed turnover rate and the system pressure drop
- 23.The chlorine carrier water pump is to be replaced
- 24.Replace soda ash dosing pump loading valve
- 25.Provide dual (run and standby) sump pump package in low level plant room sump
- 26.Provide new chemical controller as per specification
- 27.Ensure all equipment (whether new or existing) is solidly mounted

Provide separate pricing for the additional works noted below, which may be included within the contract at the client's discretion:

28.Update of Chemical Management Systems inclusive of the following:

- a. Modern Halogen electric safety shutdown in lieu of current pneumatic
- b. Upgrade injector pipe and valves to schedule 80
- c. Install Schedule 80 manifold and isolation valves for regulators
- d. Install heater drip legs to regulators
- e. Install new modern gas alarm dialler
- f. Replace injector associated components
- g. Install new carbon columns
- h. Major service on all chemistry components

29.Provide new Water treatment Switchboard to service new pump, all existing equipment, all new equipment; Provide all interlocks between water chemistry equipment and pumps, all safeties; Coordinate with and integrate the electrical switchboard with all other electrical work being conducted on the aquatic centre site by the client and other contractors.

30.Replace the concourse in its entirety with either:

- a. brushed concrete finish slab in accordance with details
- b. Paved concourse

Provide surface drainage to localised storm water drainage system.

31.Provide new pool cleaning tools including manual vacuum and associated components, robot cleaner as specified; Provide appropriate weather protected electrical outlets to suit new cleaning systems

32.Provide training as further specified for pool and water treatment plant operators

33.Provide new Operating& Maintenance manual and as-constructed drawings to suit new and existing equipment.

34.Consider issues with excavation around pool for connection of new piping to existing deep centre channel, risk and management of this process.

APPENDIX B – REMEDIATION MEASURE DRAFT SCOPE – OPTION 2

Remediation Strategy Option 2 scope recommended for council consideration is the following:

GENERAL DESCRIPTION

- Provision of a new stainless steel panel and PVC liner system within the existing pool structure
- Provision of a new wet deck around the entire perimeter of the pool
- Reduction in the depth of deep end of pool to nominally 1.8 meters depth (subject to HDWA approval)
- Replacement of pool furniture (handrails, ladders)
- Replacement of water treatment plant including construction of a new balance tank to suit Code of Practice mandated turnover (3.5 hours)
- Replacement of the pool concourse with new brushed concrete finish, exposed aggregate or prefabricated paving materials.

SPECIFIC INCLUSIONS

1. Remove existing concrete concourse
2. Cut off the existing top of the pool wall (old scum gutter construction) and remove of existing skimmer boxes
3. Fill in deepest portion of pool (currently at nominally 3+ meter water depth) to achieve nominally 1.8 meters depth at the deep end in the refurbished pool and install a new reinforced concrete floor within the existing structure
4. Remove existing tiles as necessary to install Myrtha Renovaction System
5. Install new Myrtha Renovaction System inclusive of:
 - a. A complete perimeter skimming system (wet deck) around the entire pool including stepped access areas
 - b. Screeding and levelling the existing pool floor as necessary
 - c. Installing a floor liner system (PVC) with a non-slip floor texture
 - d. Installing wall stainless steel / PVC panel system
 - e. Installing sidewall distribution nozzles
 - f. Providing equipotential bonding for all metallic components of the revised pool
 - g. Installing new water line tiles, perimeter finger grip tiles and step non-slip
6. Install new step handrails at the two stepped entries and ladder access to the pool in four locations, all in stainless steel
7. Install return-to-pool piping of an adequate size to achieved design turnover rates
8. Install balance tank return piping from the gutters to a new balance tank
9. Construct new balance tank within the filter compound
10. Install new filtration and piping system within the filter compound, sized to achieve not less than 3.5 hours turnover and good circulation through all parts of the pool

11. Install new PVC piping between the plant room and the pool, inclusive of supply to sidewall return nozzles and balance tank return piping connections from the pool wet deck gutter
12. Install new pumping and water chemistry equipment within the existing plant room in order to achieve Code of Practice mandated flowrate (3.5 Hour turnover)
13. Install a new electrical panel, and coordinating the electrical supply with the electrical design being conducted for other projects on the site
14. Provide equipotential bonding to all metallic components associated with the pool
15. Install residual current device protection to all electrical circuits
16. Replace the existing cracked concrete concourse with a new concourse constructed in either brushed concrete finish or prefabricated pavers, finished with a non-slip surface in accordance with option 1
17. Install universal access hoist in accordance with option 1
18. Resurface existing dive blocks or install new dive blocks in conjunction with pre-fabricated pool panel and gutter system
19. Update chlorine and chemical use installation inclusive of:
 - a. Halogen electric safety shutdown in lieu of current pneumatic
 - b. injector pipe and valves revised to schedule 80
 - c. Schedule 80 manifold and isolation valves for regulators
 - d. heater drip legs to regulators
 - e. new gas alarm dialler
 - f. injector associated components
 - g. new carbon columns
 - h. chlorine circulation pump
 - i. chemical controller
 - j. injector valve support
 - k. Major service on all chemistry components
20. New sump pump package for pump well in accordance with option 1
21. Improved ventilation in plant room in accordance with option 1

END