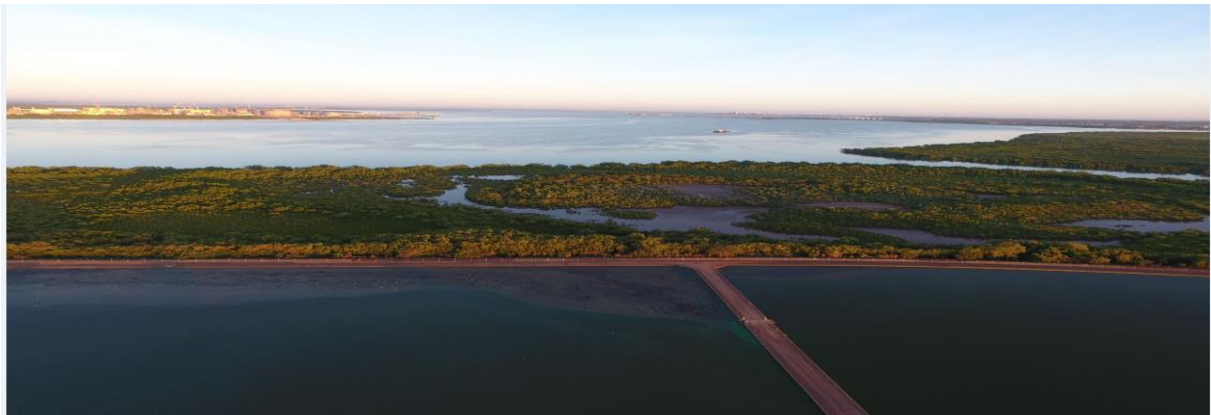


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Waste Discharge Licence 148  
Palmerston Waste Stabilisation Ponds  
Improvement Plan 2021

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*Palmerston ponds through to East Arm*



*Desludging of Ponds 3 and 4 in 2017*

[Source – PWC 2017]

Water Services  
Water Quality Group  
August 2021

## Document History and Status

Title	WDL 148 – Palmerston Waste Stabilisation Ponds Improvement Plan - 2021		
TRIM	D2021/148679		
Drafts	Date	Prepared by:	Issued to:
3.0 D2017/384797	5/09/2017	Karen Kennedy	Skefos Tsoukalis <b>Jess D'Arcy</b> Trevor Durling Wayne Sharp Eric Boyle Danny Browne
3.1 (2017 Improvement Plan for WDL 148-06 application)	6/09/2017	Karen Kennedy	DENR (Administering Agency)
4.0	19/03/2018	Jared Sellwood	Daria Surovtseva <b>Jess D'Arcy</b> Simon Brisbane Wayne Sharp Di Rose Skefos Tsoukalis Trevor Durling Eric Boyle Steven Porter Chris Seccull John Pudney Rob Brito
4.1	27/04/2018	Jared Sellwood	DENR (Administering Agency)
5.0 (2019 Improvement Plan for WDL 148-07 application)	31/07/2019	Emily Rodriguez	Dianne Rose Wayne Sharp Karen Kennedy <b>Jess D'Arcy</b> Skefos Tsoukalis
5.1 (2021 Improvement Plan for WDL 148-08 application)	21/07/2021	Andrea Georgiou	Wayne Sharp Tahlia Kemp

This document supersedes the:

- 2015 Improvement Plan (D2015/209822)
- 2016 Improvement Plan (D2016/350551)
- 2017 Improvement Plan (D2017/384797)
- 2018 Improvement Plan (D2018/122649)
- 2019 Improvement Plan (D2019/362110)

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## 1. INTRODUCTION

Power and Water Corporation operates the Palmerston Waste Stabilisation Ponds located at 80 Catalina Road, Marlow Lagoon, Northern Territory. The primary purpose of the treatment system is to provide a centralised facility for the treatment of sewage to reduce the public health risk within communities located in the sewerage catchment and to provide a treatment barrier that prevents direct faecal contamination of receiving waters consistent with the NHMRC guidelines (NHMRC 2008).

The discharge of treated effluent from Palmerston is authorised under a waste discharge licence. A waste discharge licence permits the discharge of wastewater to **'waters' in circumstances that would otherwise be an offence under the *Water Act 1992* (NT)**.

An Improvement Plan may be required to support a waste discharge licence application under the *Guidelines on Waste Discharge Licensing under the Water Act* (NTEPA 2014). The Improvement Plan must be submitted as a demonstration of commitment to the reduction and/or elimination of discharge(s) through improved wastewater quality and processes. According to this guideline –

***'The Improvement Plan must focus on reducing the zone of impact or any declared mixing zone and progressively move towards the discharge quality not compromising any beneficial use declaration or relevant water quality criteria for the receiving waters.'***

The current agreed zone of influence for the discharge has been recommended by an independent expert (Moss 2013) in consultation with both the Aquatic Health Unit of the then Department of Land Resource Management and with the Northern Territory Environment Protection Authority. It is therefore unlikely to be reduced in the foreseeable future.

The emphasis for Power and Water for the immediate future is on:

- Planning for anticipated growth within this sewerage catchment (sewerage network and plant capacity being sufficient to cater for growth); and
- Implementing water management and infrastructure management actions identified in the Darwin Harbour Water Quality Protection Plan (DLRM 2014).

As the Palmerston sewerage catchment continues to expand, this focus will prevent the zone of influence growing beyond an acceptable limit.

The current level of disturbance is considered sustainable at present, given that:

- effects are largely confined to the water column for a relatively short distance (300m);
- nutrient cycling function is consistent with control creeks;
- phytoplankton biomass is not stimulated outside of the zone of influence; and
- **'after initial dilution' as is allowed under mixing zone guidelines the potential for either acute or chronic ammonia toxicity does not present.**

**Progress against Power and Water's** water management and infrastructure management actions under the *Darwin Harbour Water Quality Protection Plan* (DLRM 2014) are detailed in Table 2 and Table 3, respectively.

## 2. BENEFICIAL USES AND WATER QUALITY CRITERIA

The receiving water body for this discharge is Myrmidon Creek. Myrmidon Creek is part of the upper estuary water type within the Darwin Harbour Region. The beneficial uses declared in 2010, under Section 73(1) of the *Water Act* for the Darwin Harbour Region, between Charles Point and Gunn Point inclusive of Buffalo Creek and Shoal Bay, bounded by the upper limit of the high water mark of tidal waterways are:

- Environment;
- Cultural; and
- Aquaculture.

The water quality criteria that are considered protective of the declared beneficial uses for the upper estuary water type are as defined in the '*Water Quality Objectives for the Darwin Harbour Region – Background Document*' (NRETAS 2010). Where appropriate, Power and Water also defers to national guidelines (ANZECC and ARMCANZ 2000a, b, NHMRC 2008). The Chief Health Officer of the Northern Territory has adopted these NHMRC Guidelines under the *Public and Environmental Health Act 2011* (NT).

The Department of Health has subsequently issued *Guidance Notes for Recreational Water Quality* in the Northern Territory (DOH 2011). In line, with the NHMRC (2008), this guidance precludes the use of *E. coli* as an indicator organism for estuarine receiving waters in favour of enterococci.

## 3. MANAGEMENT OBJECTIVES

The Power and Water 2021-2022 *Statement of Corporate Intent* was tabled in parliament detailing Power and Water's **commitment to government in setting out the corporation's nature and scope of business activities, goals, key strategies, risk management, capital investment plans and performance targets over a four year period commencing 1 July 2021** (PWC 2021). Under the *Statement of Corporate Intent*, Power and Water will continue to focus on ensuring its Operating Model is fit to meet the challenges ahead. Priority is also being given to investing in the safety of the **corporation's people and putting people and customer safety first in all that is done.**

Long-term strategic pillars of relevance to the licensed activity include:

1. Always Safe – ***Safety is Power and Water's legal and corporate obligation to its people and all Territorians. The corporation will continue to deliver on safety targets and proactively improve its safety culture to better ensure safety for its people and for all Territorians.***
2. Customer and Community at the Centre – ***Our customers and community are at the centre of the business. Power and Water's focus is on improving customer experiences, cultivating relationships and being a trusted partner with its customers, community and stakeholders.***
3. Sustainable Solutions for the Future – ***We will enable sustainable energy and water services in the NT for the future. We will enable the energy transition and help plan and achieve longer term water security. The corporation supports the NT in meeting its sustainability targets while ensuring reliable services for all Territorians.***

### 3.1 MANAGEMENT GOALS FOR THE DISCHARGE

PWC has drafted Management Goals for the discharge from Palmerston. These goals are detailed in Table 1.

Table 1 - Management Goals for the Palmerston discharge to Myrmidon Creek

Management Goals		Timeframe
Goal 1	Comply with the conditions of WDL 148	Ongoing
Statement	Except as permitted by the Licence, the discharge will not either directly or indirectly alter the properties of the receiving waters so as to render it less fit for a prescribed beneficial use.	
Actions	<ul style="list-style-type: none"> <li>• Discharge effluent via authorised discharge point only.</li> <li>• Ongoing condition monitoring and assessment in receiving environment inclusive of the zone of influence where beneficial uses may not be protected.</li> <li>• Progress performance improvement through:               <ul style="list-style-type: none"> <li>○ Improvement plan actions; and</li> <li>○ Periodic risk assessment updates.</li> </ul> </li> </ul>	
Goal 2	Improve treatment efficacy within the constraints of the existing infrastructure	Ongoing
Statement	PWC will operate the ponds in a manner that ensures optimal treatment performance	
Actions	<ul style="list-style-type: none"> <li>• Implement routine wastewater quality monitoring program across the treatment train.</li> <li>• Routine inspections of pond condition and maintenance.</li> </ul>	

## 4. 2021 IMPROVEMENT PLAN ACTIONS

Under this Improvement Plan, Power and Water will ensure that in order to minimise impacts associated with the licensed activity that:

- The discharge of treated effluent from the Palmerston Waste Stabilisation Ponds will be undertaken within the legal framework provided by the licence; and that
- Power and Water will progress the management actions identified in Table 2 and Table 3, within budget constraints.

Table 2 - Darwin Harbour Water Quality Protection Plan – *Power and Water Corporation Water Management Actions*

Action No.	Action Identified	Action Progress	Timeframes
Completed			
1.	Targeted biological monitoring of carbon and nitrogen isotopes	Designed by an independent expert and implemented. Potential to distinguish nutrient sources accumulated in biological matrices and define the spatial extent of the accumulation of sewage derived nutrient inputs into biological matrices ( <i>Rhizophora stylosa</i> )	2014 - 2015
Completed and Ongoing			
2.	Development of site specific trigger values for receiving waters	Independent expert consulted and site specific trigger values subsequently integrated into reporting limits for Myrmidon Creek in 2013	2013 - ongoing
3.	Routine water quality monitoring	Routine wastewater and receiving water quality monitoring programs developed, implemented and refined	2012 - ongoing
4.	Targeted sediment monitoring	Routine dry season sediment monitoring programs implemented and subsequently re-designed and implemented based on independent expert review of critical parameters	2012 - ongoing
Ongoing			
5.	Development of a hydrodynamic water quality model for receiving waters	<ul style="list-style-type: none"> <li>PWC has facilitated access/approvals for the Palmerston Outfall Dye Study (Patterson 2014) – looking at the influence of the mangrove environments near the outfalls on mixing and how well the Darwin Harbour Hydrodynamic Model simulates this.</li> <li>PWC has focussed on model mesh development/extension within the more complex Buffalo Creek/Shoal Bay environment and relies on the current mesh within Myrmidon Creek.</li> <li>The approach developed to applying the model within Buffalo Creek has improved the way that the model is applied in Myrmidon Creek and other receiving waters (subject to peer review).</li> <li>PWC is beginning to apply the model as one tool to predict the implication of predicted growth scenarios to a 2030 horizon at the Palmerston outfall.</li> </ul>	The hydrodynamic water quality model for Myrmidon Creek is available for scenario modelling - ongoing
6.	Assessment of condition of local waters receiving sewage treatment plant discharges	Monitoring reports prepared annually, which benchmark water quality to default water quality criteria.	Ongoing

Table 3 - Darwin Harbour Water Quality Protection Plan – *Power and Water Corporation Infrastructure Management Actions*

Action No.	Action Identified	Action Progress	Timeframes
Completed			
1.	Engagement of experts in waste stabilisation pond technology and operation to assist with process review and improvement	<ul style="list-style-type: none"> <li>PWC engaged an independent expert to undertake a capacity and condition review and recommend operational improvement measures for WSPs inclusive of the Palmerston WSPs</li> </ul>	2010
2.	Development and publication of waste stabilisation pond planning and design manuals	<ul style="list-style-type: none"> <li>PWC has a dedicated <i>Waste Stabilisation Pond Design Manual (Ashworth and Skinner 2011)</i> that will be used to design any future pond systems.</li> <li>PWC has prepared an <i>Asset Summary</i> (PWC 2011) for the Palmerston WSPs that will be updated periodically. The <i>Asset Summary</i> was last updated in 2019 and is awaiting finalisation.</li> </ul>	2011
3.	Estimate gross pollutant influent load	<ul style="list-style-type: none"> <li>Gross pollutant influent load estimated from the approximate mass of screenings removed by the Ludmilla WwTP, divided by the estimated population (EP) of the Ludmilla sewer catchment, multiplied by the EP for the Palmerston WwTP sewer catchment.                             <ul style="list-style-type: none"> <li>Updated gross pollutant influent load estimate with current equivalent persons estimate for 2018.</li> <li>Updated gross pollutant influent load estimate with most recent equivalent persons estimate for 2018-19, 2019-20 and 2020-21.</li> </ul> </li> </ul>	2015-2016 2017-2018 2019-2021
Completed and Ongoing			
4.	Development and management of bulk wastewater receiving pond at Palmerston WwTP	<ul style="list-style-type: none"> <li>Bulk waste ponds completed and bulk waste managed under the Bulk Waste Management System including, bulk waste agreements; spot checks; 24 hour video surveillance; random sampling and waste tracking.</li> </ul>	Complete - ongoing
5.	Ongoing desludging program at all waste stabilisation ponds	<ul style="list-style-type: none"> <li>Pond 1 was desludged in 2012.</li> <li>Pond 2 was desludged in 2014.</li> <li>Pond 3 &amp; 4 were desludged in 2017.</li> <li>Pond 5 was desludged in 2020. 90% of sludge volume removed, estimated based on sonar boat survey in October 2019.</li> <li>The Trade Waste Ponds are desludged on an annual basis.</li> </ul>	Complete - ongoing
6.	Desludge inlet ends to facultative and maturation ponds	<ul style="list-style-type: none"> <li>Pond 1 was desludged in 2012.</li> <li>Pond 2 was desludged in 2014.</li> </ul>	Complete - ongoing



Action No.	Action Identified	Action Progress	Timeframes
		<ul style="list-style-type: none"> <li>• Pond 3 &amp; 4 were desludged in 2017.</li> <li>• Pond 5 was desludged in 2020.</li> <li>• The Trade Waste Ponds are desludged on an annual basis.</li> </ul>	
7.	Deploy methods to aid vertical mixing during windless periods (focus on facultative ponds)	<ul style="list-style-type: none"> <li>• Two aerators purchased and trialled in Palmerston P1 (facultative pond) and P2 (first maturation pond). It was identified that recirculation provided better performance outcomes - a recirculation upgrade project was initiated (refer to Action No. 8).</li> </ul>	Complete - ongoing
8.	Enhancement of the existing recirculation system to allow access of a better effluent quality and to increase the volumetric capacity of the recirculation system.	<ul style="list-style-type: none"> <li>• Recirculation upgrade project: Installed new pump and repositioned the existing offtake point from the start of Pond 5 to the end of Pond 5 following the desludging of Pond 5 in August 2020. Project is ongoing.</li> </ul>	Complete - ongoing
9.	Undertake operator training in pond crash prevention	<ul style="list-style-type: none"> <li>• PWC has prepared a Waste Stabilisation Pond – Basic Operation Manual (BDOC2012/113 Version 2018) which forms a key training tool for operations. The manual includes details pertinent observations and causes of pond crash. These observations are integrated into the routine inspection checklists for pond sites.</li> </ul>	Complete - ongoing
10.	Sludge surveys	<p>Conduct periodic sludge surveys to inform the desludging program.</p> <ul style="list-style-type: none"> <li>• Pond 4 sludge survey completed in October 2019.</li> <li>• Pond 1, 2, and 5 sludge survey completed in November 2019.</li> <li>• Pond 3 sludge survey completed in October 2020.</li> </ul>	Complete - ongoing
11.	Research and pilot studies	<ul style="list-style-type: none"> <li>• Research projects that PWC supports that incorporate Myrmidon Creek include: <ul style="list-style-type: none"> <li>○ Development and validation of quantitative PCR assays targeting microbial nitrogen cycle genes: a tool to monitor ecosystem function in sediment</li> <li>○ Microbiology of a tropical creek impacted by sewage effluent. Novel impact assessment using N cycle functional markers and changes in bacterial community composition.</li> <li>○ N and C isotope honours project – source signatures and identifying zones of influence for sewage derived nutrient uptake</li> </ul> </li> </ul>	Complete - ongoing
Ongoing			

Action No.	Action Identified	Action Progress	Timeframes
12.	Ongoing sewerage network upgrade projects	<ul style="list-style-type: none"> <li>Augmentation of sewage infrastructure is ongoing in order to meet the planned growth for the Palmerston and surrounding areas.</li> </ul>	Ongoing
13.	Development and implementation of an Inflow and Infiltration Abatement Programme for Darwin Region sewerage systems	<ul style="list-style-type: none"> <li>PWC have invested heavily in an infiltration program and have identified key catchments where infiltration into the sewerage system is substantial. Palmerston sewerage infrastructure is relatively new compared with the other catchments and is not currently a priority for remediation.</li> </ul>	Ongoing
14.	Implementation of an operational improvement program at all sewage treatment plants to maintain design and treatment capacity and capability	<ul style="list-style-type: none"> <li>Recommendations made for operational improvement at the Palmerston WSPs under Action No. 1 are continuing to be implemented within budgetary constraints.</li> </ul>	In progress
15.	Deploy methods to remove or sink surface scums	<ul style="list-style-type: none"> <li>Surface scum removal undertaken several times per year. Either wind action or a boat/curtain system is used to concentrate scums which are removed via the use of a sucker truck.</li> </ul>	Ongoing
16.	Undertake pond embankment integrity study	<ul style="list-style-type: none"> <li>Wall integrity surveyed and repaired during desludging activities</li> </ul>	Ongoing
17.	Implement pond inlet and outlet hydraulic improvements including pond stub baffle walls and partitioning	<ul style="list-style-type: none"> <li>Curtains installed in pond 2 to optimise hydraulic performance.</li> <li>System performance optimised by use of various inlets and outlets to stop short circuiting.</li> <li>New pump and repositioning of the existing offtake point to increase recirculation capacity (Recirculation upgrade project Action No. 8).</li> </ul>	Ongoing
18.	Sewered equivalent population to be established and correlated against flow	<ul style="list-style-type: none"> <li>Modelled and correlated against flow - cross referenced to ABS population in sewage catchment and retail customer data as required.</li> </ul>	Ongoing
19.	Document monthly observations of litter within the discharge zone of influence during Darwin Harbour Surface Water Monitoring Program sampling	<ul style="list-style-type: none"> <li>External consultant have completed (and will continue to do so) monthly observations at all sampling sites within Myrmidon Creek and at the outfall and no litter has been present (monthly photos are taken as part of our record collection).</li> </ul>	Ongoing

Action No.	Action Identified	Action Progress	Timeframes
20.	Develop and implement an advertising Campaign to inform the public on the flushability of products and what not to put down drains.	<ul style="list-style-type: none"> <li>Information on what not to put down the toilet and drains on the PWC website</li> <li>Increase public awareness by utilising the International Water Services Flushability Group (IWSFG) flushability specifications to inform the public on <b>what can and can't be flushed down the toilet in</b> the aim of reducing gross pollutants within sewer systems.</li> <li><b>The three p's campaign also known as "What you flush makes a difference"</b> <a href="https://www.powerwater.com.au/about/what-we-do/wastewater">https://www.powerwater.com.au/about/what-we-do/wastewater</a></li> </ul>	Ongoing
21.	Engage independent expert consultant for the development of future plans for wastewater treatment facilities in Ludmilla, Berrimah and Palmerston	<ul style="list-style-type: none"> <li>Independent expert consultant engaged in 2021 to develop masterplans for Palmerston sewerage catchment including both short-term improvements and long-term treatment options for Palmerston WSP site, accommodating future growth, current asset condition, network issues and regulatory requirements.</li> </ul>	Ongoing
22.	Engineering studies looking at treatment upgrade options; outfall augmentation options; and recycled water treatment and network options	<ul style="list-style-type: none"> <li>The focus for all PWC wastewater sites is to plan for growth/capacity to a 2050 horizon. Development of masterplans for Palmerston sewerage catchment are ongoing – refer to Action No. 21.</li> <li>There are no current reuse applications for the effluent from Palmerston WSPs, although some infrastructure has been constructed in the final pond that could be utilised should a feasible application arise.</li> </ul>	Ongoing
23.	Development of Site Specific Pond Operating Manual, Emergency Response Manual and Operator Training Manual.	<ul style="list-style-type: none"> <li>Prepared and awaiting finalisation.</li> </ul>	In progress 2019 - 2022
24.	Investigation into future plans for the Bulk Waste Ponds	<ul style="list-style-type: none"> <li>An independent review of the bulk waste inlet ponds has been completed along with recommendations for both capital and operational improvements to optimise the ponds.</li> <li>An improved management system has been developed and implemented allowing for more effective monitoring and management of bulk wastes.</li> </ul>	Ongoing – in progress 2021 - 2022
Proposed			
25.	Undertake investigation and develop report on improved	<ul style="list-style-type: none"> <li>Studies have been prioritised at the Leanyer Sanderson <b>WSP's and on completion will commence at Palmerston WSP's. The knowledge and</b></li> </ul>	2021 - 2022

Action No.	Action Identified	Action Progress	Timeframes
	monitoring of pond temperature inversions (as per WDL 148-06 Condition 36.2).	<b>information learnt from the Leanyer Sanderson WSP's study will be transferred to the Palmerston WSP's.</b>	
26.	Update estimate gross pollutant influent load	<ul style="list-style-type: none"> <li>Update influent load estimate with current equivalent persons estimate for 2022.</li> </ul>	2022 - 2023
27.	Undertake investigation and develop report on options to further limit gross pollutants in the immediate discharge area (WDL 148-06 Condition 36.3).	<ul style="list-style-type: none"> <li>A review will be undertaken to develop a solution to capture any discharged gross pollutants to Myrmidon creek.</li> </ul>	2023 - 2024
Re-prioritised			
28.	Complete inlet works preliminary design based on pond hydraulic assessment	<ul style="list-style-type: none"> <li>An Inlet Works Strategy has been prepared that covers generic recommendations for equipment selection, sizing and layout.</li> <li>Preliminary design will not be undertaken due to budgetary and timeframe constraints – refer to Action No. 29.</li> </ul>	Re-prioritised due to budgetary constraints
29.	Detailed design, tender and construct inlet works including dual screens, storm bypass and possibly conversion of a maturation pond to a storm tank	<ul style="list-style-type: none"> <li>Inlet works at Palmerston have not progressed to the design phase, initially due to the prioritisation of Leanyer Sanderson WSP Inlet Works (construction in 2017 to December 2018) and Ludmilla WwTPs in terms of capital expenditure.</li> <li>Air scrubbers (carbon filters) have been installed within the inlet to the ponds to assist with a reduction in odour.</li> <li>Awaiting Palmerston masterplanning (Action No. 21) and recirculation upgrade (Action No. 8) outcomes to inform on upgrade requirements.</li> </ul>	Re-prioritised due to budgetary and scope / timeframe constraints
30.	Engage City of Darwin Council (CoD) and Palmerston City Council (PCC) for advice on pollutant measurement methods for stormwater	<ul style="list-style-type: none"> <li>CoD and PCC to be contacted to determine if any methods used for pollutant measurement of stormwater could be applied for wastewater purposes.</li> <li>Awaiting outcomes from Palmerston masterplanning (Action No. 21), recirculation upgrade (Action No. 8), Leanyer Sanderson WSPs and Ludmilla WwTP projects.</li> </ul>	Re-prioritised due to budgetary and scope / timeframe constraints

Action No.	Action Identified	Action Progress	Timeframes
31.	Undertake review of other Australian utilities on of Litter Characterisation	<ul style="list-style-type: none"> <li>• PWC to investigate what other utilities are doing in about effluent load of litter characterisation.</li> <li>• Awaiting outcomes from Palmerston masterplanning (Action No. 21), recirculation upgrade (Action No. 8), Leanyer Sanderson WSPs and Ludmilla WwTP projects.</li> </ul>	Re-prioritised due to budgetary and scope / timeframe constraints
32.	Undertake an internal review of effectiveness of Leanyer Sanderson Inlet Works screening process in removing litter from the influent	<ul style="list-style-type: none"> <li>• Re-prioritised to obtain adequate dry and wet season data to review the effectiveness of the screening at Leanyer Sanderson Inlet (inlet works completed in December 2018). A year-long review to be undertaken in 2022 to assess performance during a wet and dry season.</li> </ul>	Re-prioritised due to timeframe constraints
33.	Review facultative pond hydraulics	<ul style="list-style-type: none"> <li>• Modelled – awaiting verification of modelling outputs, outcomes of Palmerston Masterplans (Action No. 21), and performance of re-circulation upgrade (Action No. 8). To be reviewed based on recent desludging outcomes.</li> </ul>	Re-prioritised due to scope / timeframe constraints
34.	Review maturation pond hydraulics	<ul style="list-style-type: none"> <li>• Modelled – awaiting verification of modelling outputs, outcomes of Palmerston Masterplans (Action No. 21), and performance of re-circulation upgrade (Action No. 8). To be reviewed based on recent desludging outcomes.</li> </ul>	Re-prioritised due to scope / timeframe constraints

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