

IR-F09 Application Form – Category 54 License Application: The Landing Wastewater Treatment Plant, Port Hedland

Attachment 3B

1 INTRODUCTION

The Landing and the Walkabout accommodations are located adjacent to the Port Hedland airport, which is approximately 1600 km north of Perth, Western Australia.

The Landing mining accommodation and the Walkabout motel have been in operation since the late 1970s. Both accommodations utilised 3 and 2 wastewater stabilisation ponds, respectively, which were co-located in the current position. During various historic amendments the five ponds have been combined into one wastewater treatment plant (WWTP) of sequential ponds.

The WWTP has never been licensed or registered under the *Environmental Protection Regulations 1987*. The current license application is intended to achieve regulatory compliance. There are no historic records of discharge from the existing WWTP.

The capacity of the WWTP has been modelled utilising the following data:

- Sampling of influent quality for biochemical oxygen demand (BOD), pH and total nitrogen (TN). The influent total phosphorus (TP) was below ANZECC guidelines for environmental discharge to land.
- Geotechnical testing of evaporation ponds infiltration rates.
- Survey of the existing ponds dimensions (depths were conservatively estimated)
- Daily flow meter data from two (2) flow meters from each accommodation site
- Supplier information of Pittboss evaporators data from Telfer mine site – 11 evaporation units are installed on the 5 ponds.
- Anecdotal observation of final pond 5 dry conditions for up to 6 months of the year.

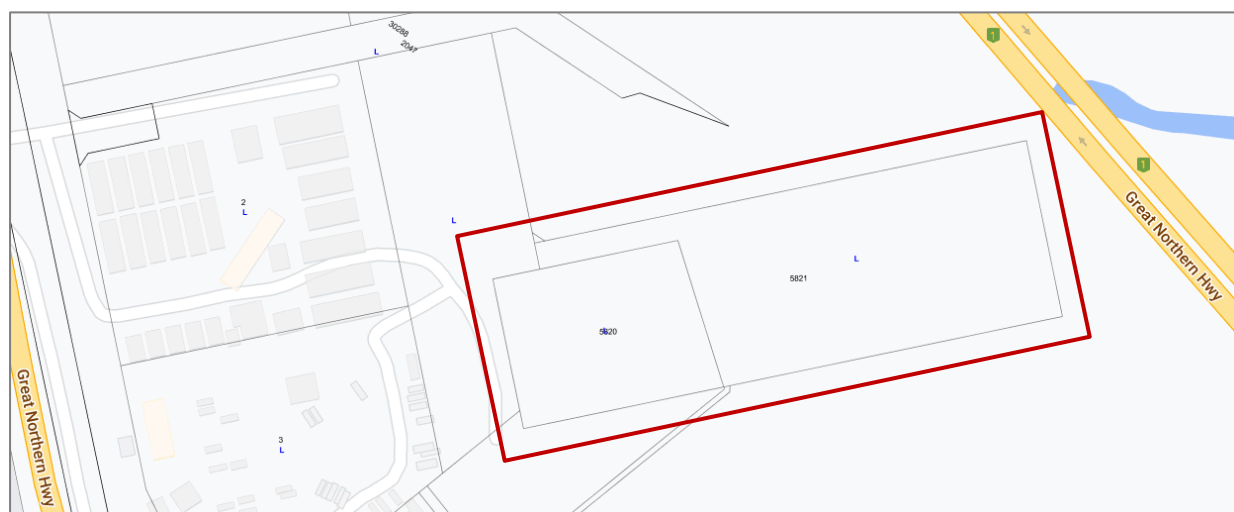
2 BACKGROUND

2.1 Location

The Landing WWTP is located on Lot No. 5820 and 5821 (Plan number: P189888), Great Northern Highway, Port Hedland, WA, which is immediately east of the Port Hedland International Airport and north of BHP's Port Haven accommodation village.

The Landing and Walkabout accommodation, including the WWTP, are owned by QSD Hire Pty Ltd and Walkabout Holdings Pty Ltd, respectively.

Figure 1: Location and land tenure of the Landing Wastewater Treatment Plant (Landgate, WA)



2.2 Existing WWTP

The existing Landing WWTP comprises five ponds, including three (3) facultative treatment ponds and two (2) evaporation / infiltration ponds.

Ponds 1, 2 and 3 are clay lined with each having a freeboard of 500 mm (greater than Pilbara 400 mm standard).

Ponds 4 and 5 are not lined and each have a 1000 mm freeboard. Pond 5 includes an emergency overflow pipe that discharges to local Main Roads WA drainage culvert under the newly constructed Great Northern Highway diversion. The receiving environment is a saline creek system, as adjacent to the solar salt production ponds (Dampier Salt Ltd).

The WWTP survey and general arrangement is included in addendum to this Attachment 3B.

Figure 2: WWTP ponds arrangement – sewer mains red, ponds connector pipes blue, emergency discharge point yellow



Table 1 Dimensions of the WWTP Ponds

		Lining	TOB Length (m)	TOB Breadth (m)	Water Depth H (m)	Pond Volume (m ³)
Pond 1	Primary facultative	Clay	45	39	1.45	1728
Pond 2	Secondary facultative	Clay	78	24	1.55	1783
Pond 3	Secondary facultative	Clay	77	28	1.38	2011
Pond 4	Evaporation pond	None	74	70	1.15	4495
Pond 5	Evaporation pond	None	105	70	1.20	6915

Eleven (11) evaporators are strategically placed throughout the system: one each on ponds 1, 2 and 3; four evaporators in pond 4 and four evaporators in pond 5.

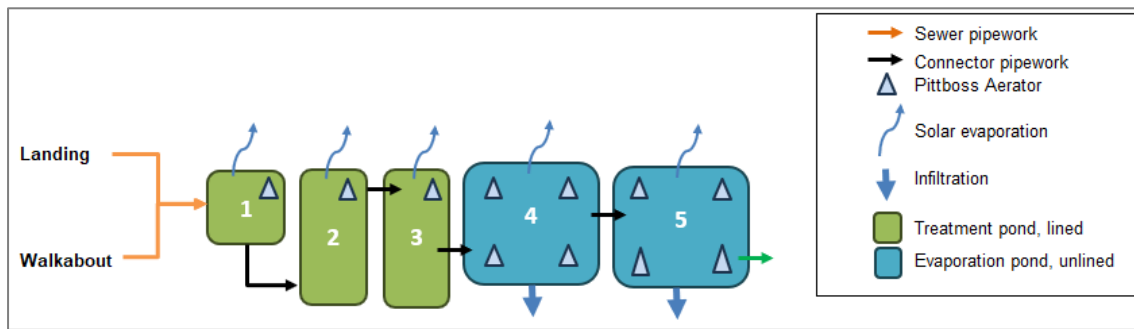
The supplier product information is available at <https://www.resourcewest.com/> and the local supplier is www.trinvest.com.au

Further detail on the modelling of the evaporation is included in the following sections.

The Pittboss product was selected to prevent any airborne spray of wastewater; the product is reported to work by fanning air downward onto the water surface to promote aeration at the surface.

Attachment 3B: The Landing WWTP

Figure 3: Landing WWTP ponds schematic receiving sewage from Landing & Walkabout accommodations



2.3 Environment

Environmental surveys, risk assessment and sampling were not available for the site.

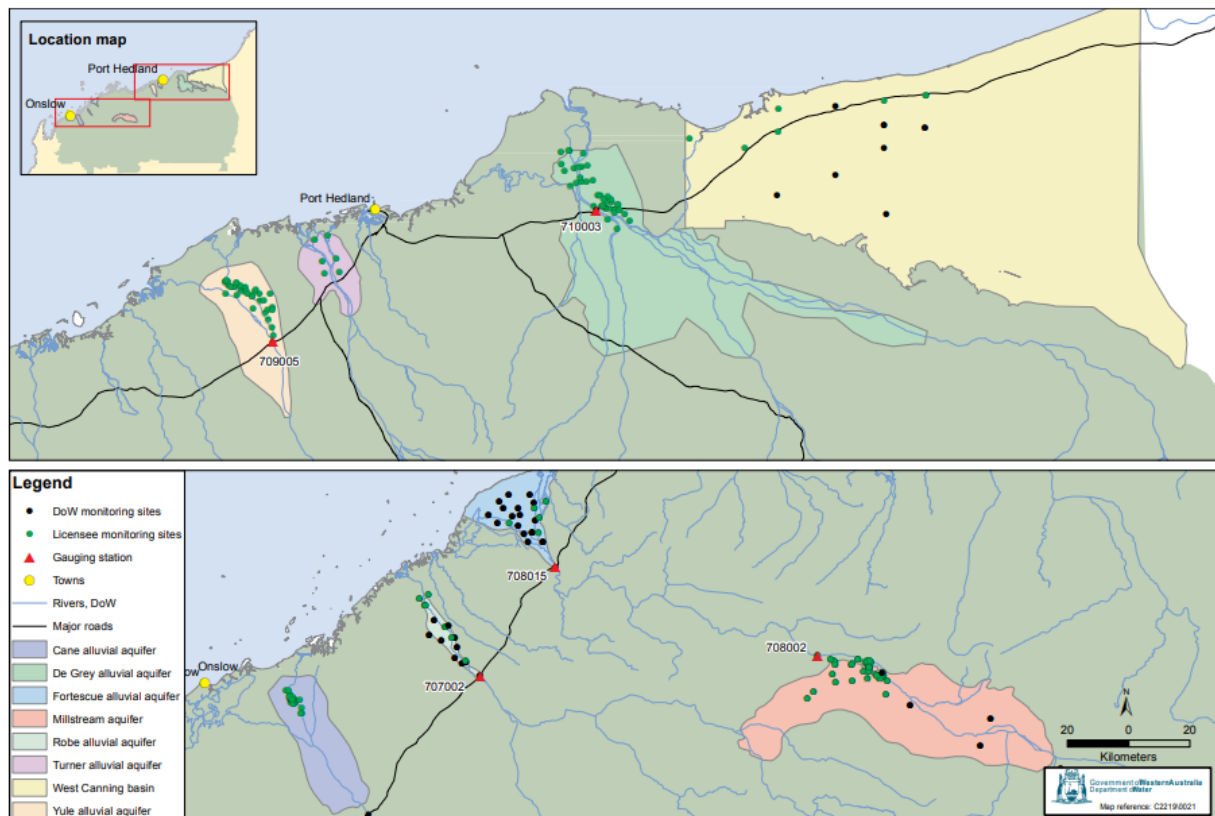
The existing WWTP is a disturbed environment and no new native vegetation clearing will occur during operation of the WWTP.

The following groundwater information was referenced from the [Pilbara groundwater allocation plan](http://www.wa.gov.au) (www.wa.gov.au) (Dept of Water, 2013).

The freshwater aquifers at Yule, Turner and De Grey Rivers are external to the Port Hedland area. The groundwater underlying the Landing WWTP site were described as saline.

There are no receiving fresh surface waters. The adjacent site to the east is the Port Hedland salt mine of Dampier Salt Ltd (Rio Tinto).

Figure 4 Port Hedland surrounding proclaimed groundwater areas (Dept of Water 2013).



2.4 2023 Operational History

As the WWTP design is not available the pond capacity has been modelled to determine the capacity for DWER Licensing purposes. The model was developed and calibrated based on the following information from the operator.

2.4.1 Flow Data

Two (2) flow meters are installed on the sewer pressure mains from the Walkabout Motel and the Landing. Daily metering for March – September 2023 reported an average of **195.7 m³/day** for the period. Monthly averages are shown in Table 1 below.

No overflow to environment was reported during this monitoring period.

Ponds 4 and 5 are not lined and infiltration is occurring in addition to the solar evaporation. A Pitboss evaporator was installed and operating on treatment ponds 1, 2 and 3. In addition, four Pitboss evaporators were operated on each pond 4 and pond 5.

Pond 5 was reported to be empty for approximately 6 months of the year in 2023.

Table 2 Landing and Walkabout sewer flow meters' total readings for 2023

	Mar-23	Apr-23	May-23	Jun-23	Jul-23	Aug-23	Sep-23
Total (kL)	5,952	5,286	6,293	6,358	6,744	5,789	2,009
Average Daily Inflow (kL/day)	192.0	176.2	203.0	212.0	217.6	186.7	182.6

2.4.2 Water Quality Data

Two (2) raw sewage samples were taken on 26th November 2023 at the wastewater entry into the primary pond. One midday (kitchen operations) and one evening (shift end) sample during peak flow events.

Historic treated effluent quality data was not available.

Table 3: Design Influent Parameters

Parameters	Unit	Sample 26/11 13:00	Sample 26/11 18:00	Model Value
Biochemical Oxygen Demand (BOD)	mg/L	538	288	450
Total Nitrogen (TN)	mg/L	40.2	47.2	45.0
Total Phosphorus (TP)	mg/L	7.74	7.45	7.5
Total Suspended Solids (TSS)	mg/L	160	89	150
pH	-	6.86	7.61	7.5

2.5 Health Regulations

There is no treated effluent irrigation or recycling occurring at the Landing WWTP. Therefore, is no trigger for the application of the Dept of Health 'Guidelines for the non-potable uses of recycled water in Western Australia'.

The WWTP is existing and therefore the Dept of Health *Application to Construct or install and Apparatus for the Treatment of Sewage*, is not applicable.

3 BACK ENGINEERING OF WWTP CAPACITY

3.1 Treated Effluent Quality Target

The *Australian Guidelines for Sewerage Systems: Effluent Management* (ANZECC, 1997) treated sewage quality for discharge to land were applied as listed in Table 4 as the treated effluent target at end of pond 3 prior to infiltration discharge to land via ponds 4 and 5.

Table 4 ANZECC (1997) Limits for Discharge to Land

Parameter	ANZECC Limits
Biochemical Oxygen Demand (BOD)	30 mg/L
Total Nitrogen (TN)	50 mg/L
Total Phosphorus (TP)	12 mg/L

3.2 Treatment Capacity

The first three (3) facultative ponds are shallow but are of sufficient depth and dimensions to achieve the required BOD and nitrogen removal at 195 kL/day (current throughput) and up to 450 kL/day when treatment is limited by BOD removal. The raw sewage pH is sufficient for nitrogen removal without additional pH adjustment. The sampled sewage phosphorus is less than the required effluent quality limit.

At 450 kL/day throughput capacity the sequential treatment in the ponds will be as follows:

Table 5 Modelled water treatment capacity of Landing WWTP at 450 kL/day

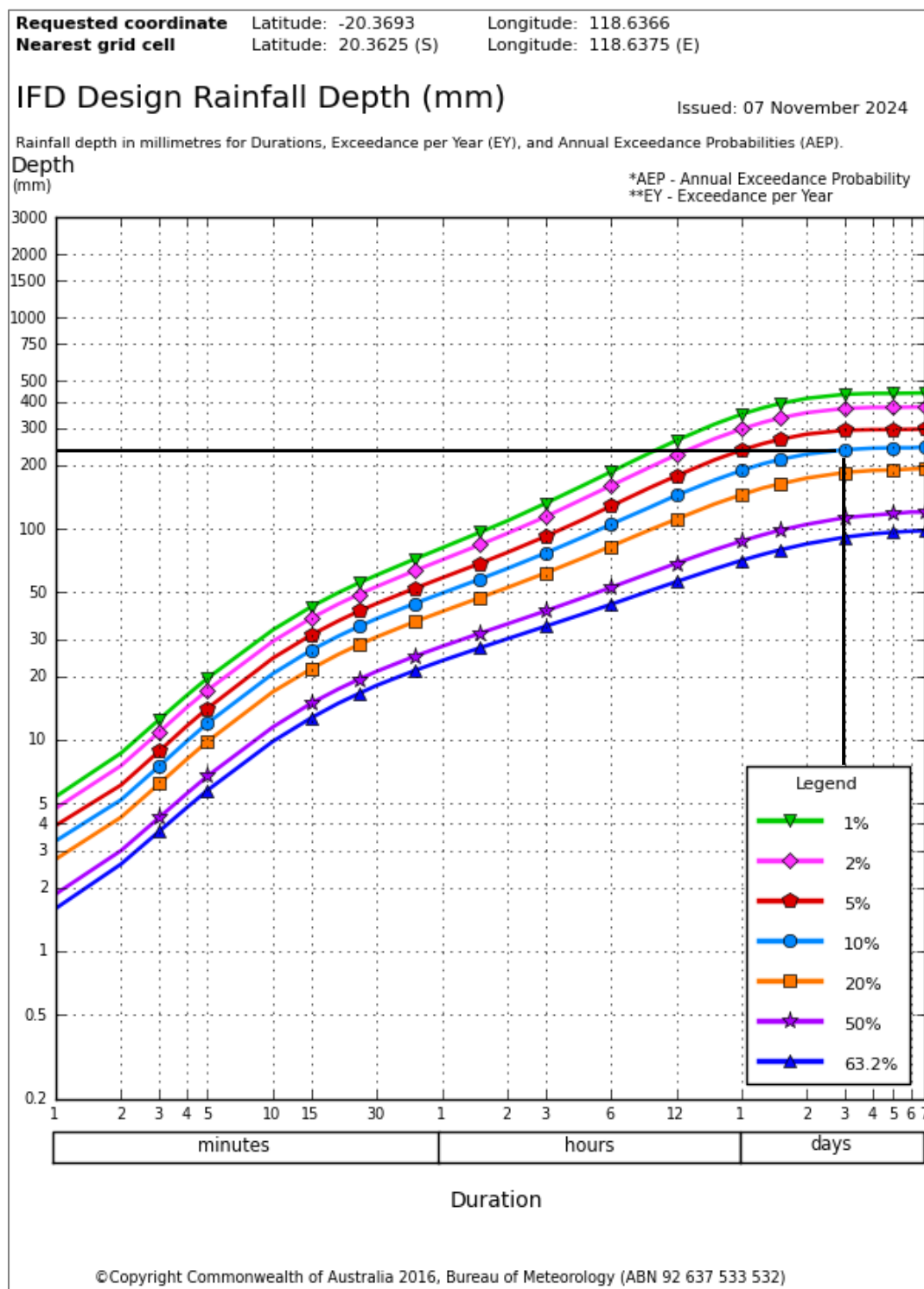
Parameter	BOD	TN	TP
Unit	mg/L	mg/L	mg/L
Influent	450	45.0	7.5
Pond 1	193	30.5	
Pond 2	73	21.3	
Pond 3	25.6	14.6	
Effluent limit	30	50	12
Removal efficiency	95%	68%	

3.3 Ponds Freeboard

For the Landing / Walkabout location the 72-hour rainfall, 10% annual exceedance probability is recorded as 237mm (refer Figure 5). The WWTP survey and general arrangement are included in addendum to this Attachment 3B.

The existing freeboard in treatment ponds 1, 2 and 3 is 500mm and the evaporation ponds 4 and 5 freeboard is at 1,000mm.

Figure 5 Bureau of Meteorology 'Design Rainfall Data System' (2016) for Port Hedland location



3.4 Water Balance

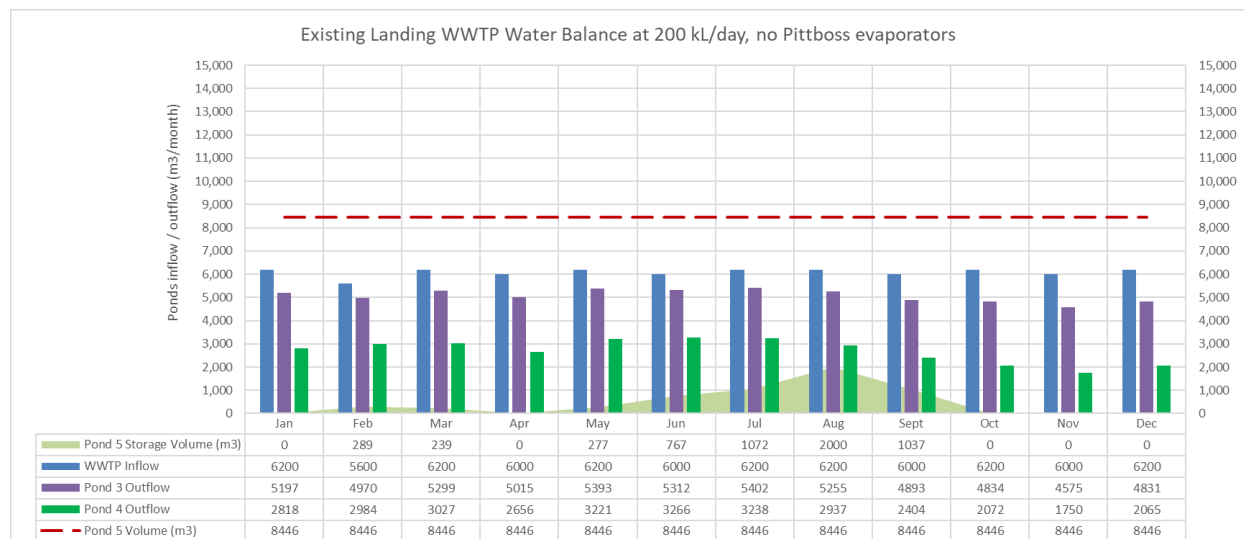
3.4.1 Existing Operations Model Calibration

The water balance model for the waste stabilisation ponds referenced the following data:

- Bureau of Meteorology (BoM) mean monthly rainfall and evaporation data from Port Hedland Aero (station No. 004032).
- Monthly evaporation data from dams in Port Hedland region, sourced from *Evaporation Data for Western Australia* by G.J. Burke, K.L. O'Brien, and T.M. O'Brien (1987).
- Pond 5 material sample was tested by Construction Services Pty Ltd to have permeability of $K_{sat} 5 \times 10^{-6}$ m/s. This figure is conservative as it was a lab recompacted sample test. The insitu material will be less compacted. An assumption of 35% reduction in the infiltration capacity was also applied to achieve model calibration.
- PittBoss evaporator water losses were based on supplier monitored data from Telfer mine site to be between 42 – 56 L/minute/unit, subject to air temperature and humidity. This equates to 1330 – 1940 kL/month/unit.
- The operator reports that Pittboss evaporators were operational for part of the day over approx. 4 weeks in winter 2022-23 when there was water in Pond 5 but this left the final two (2) ponds unnecessarily empty (unnecessary power consumption). The evaporators were turned off but observed to be effective. No further measurements were taken.
- The operator reports that Pond 5 is empty for approx. 5 – 6 months of the year at the current flow rates.

Using the above data the water balance model was calibrated as shown below, for 200 kL/day and without operation of the evaporators. The total volume of Pond 5 is shown with the red, dashed line and the Pond 5 volume is shown in pale green.

Figure 6 Landing WWTP Water Balance for existing operations 200 kL/day



3.4.2 Maximum Throughput Capacity 450 kL/day

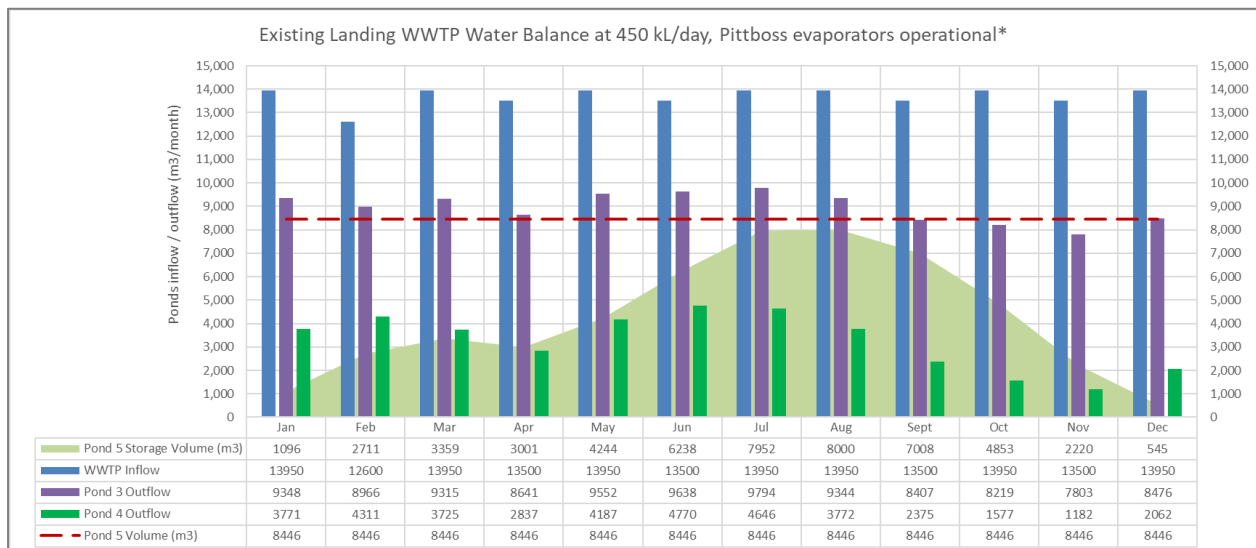
Extrapolating the model for greater volume throughout to match the treatment capacity of 450 kL/day included the following additional assumptions:

- Pittboss evaporators will be operating in Ponds 1, 2 and 3 (1 on each pond) at 75% of supplier defined capacity - either as reduced operating time or safety factor for defined operating efficiency for modelling purposes.
- Four (4) Pittboss evaporators will be operating in Pond 4 at 50% of supplier defined capacity – either as reduced operating time or modelling safety factor.
- Four (4) Pittboss evaporators Pond 5 will not be required.

The modelled average evaporation volume from the total, seven (7) evaporators was 1005 kL/month or 33.5 kL/day. This was considered a conservative estimate given the eleven (11) evaporators available.

The model shows that Pond 5 has adequate storage to balance 450 kL/day capacity without discharge to environment and will have low water volumes during the Pilbara cyclone season.

Figure 7 Landing WWTP Water Balance for maximum throughput 450 kL/day



3.4.3 Monitoring & Verification

It is anticipated that the regulator may not be familiar with the evaporator equipment which differs from typical water jets or cannons (aerosol evaporators).

The model indicates 450kL/day maximum throughput capacity, subject to monitoring of evaporators operating hours and efficacy as demonstrated by water levels or flow monitoring.

As the water balance is selected to match the back-engineered treatment capacity, any variation to the water balance would only require an additional evaporation basin should the evaporators underperform. The likelihood of this occurring would be monitored and is considered to be of low risk by the applicant.