Memorandum

23 September 2013

To	Brent Murdoch		
Copy to	Andrew Sawicki		
From	Nicole Conroy	Tel	(08) 8982 0109
Subject	EIS Supplementary responses relating to Surface Water assessment	Job no.	43/22079

1 This section of the Supplementary report addresses submission #57 and #59 from NT EPA relating to Environmental risk assessment and surface water.

The risk assessment and discussion on surface water management throughout the draft EIS uses terminology such as "extreme" rainfall event, "severe" rainfall event and "normal conditions", yet these terms are not defined. It is not clear what scale of event is considered normal or requires additional management response. Page 10-16 states that "significant water storage will be designed for the containment of at least monthly and likely extreme wet season rainfall', while Appendix I (page i) states design for the "containment of at least monthly and preferably extreme wet season rain."

Further information is requested on:

- *definition of terms used to describe rainfall events, including "normal conditions", "severe" and "extreme" rainfall;*
- *clarification on the anticipated rainfall event(s) that significant water storage infrastructure will be designed for; and*
- *the exceptional circumstances where retention ponds are expected to overflow.*

Further information is requested on:

- *clarification on the anticipated rainfall event(s)that significant water storage infrastructure will be designed for; and*
- *the exceptional circumstances where retention ponds are expected to overflow.*

Table 5-6, SWOI and SW02: Both identified risks have a residual risk rating of medium. It is not clear how this rating has been reached (e. g. likelihood and consequences for each risk after proposed mitigation measures are implemented are not provided and justified).

Further information is requested on justification for the risk rating of medium for risks SWOI and SW02

Table 5-6, SW04 - Residual Risk of Failure of the WTP should be reassessed or further justified. The consequences of failure are considered to be higher than stated; this is the only treatment *option provided for all the acid and metalliferous drainage (AMD) waters from the site.*

1.1 Definition of terms used to describe rainfall events

The Australian Rainfall and Runoff (AR&R) manual Book VI, Section 3.1.3, Table 4 categorises design storm rainfall as follows:

'large' (denoting an annual exceedance probability (AEP) of between 1 in 50 yrs to 1 in 100 yrs);

'rare' (denoting an AEP beyond 1 in 100 yrs and up to credible limits of rainfall extrapolation); and

'extreme' (probable maximum precipitation).

On reflection it would have been better to use the AR&R terminology when referring to rainfall events. For ease of reference the AR&R nomenclature of 'large', 'rare' and 'extreme' should be augmented in this report by the terms:

'normal' which is intended to reflect events which are likely to occur with an annual frequency of occurrence; and

'moderately large' which is intended to reflect events with an AEP of up to 1 in 50 yrs.

Therefore, the following text, together with all other references to 'extreme', requires editing.

The word "extreme" on Page 10-16 in the sentence that states "significant water storage will be designed for the containment of at least monthly and likely extreme wet season rainfall', should be replaced with the words "moderately large".

The word "extreme" on page i of Appendix I that states "containment of at least monthly and preferably extreme wet season rain..." should be replaced with the words "moderately large".

1.2 Clarification on the anticipated rainfall event(s) that significant water storage infrastructure will be designed for.

Elsewhere in Australia, notably Queensland, the performance criteria for the design of water containment is based on its hazard classification. Water containment structures that are classified as being a 'significant' hazard are expected to have a storage capacity that is capable of containing the rainfall/runoff during a 1:20 yr AEP wet season and its overflow structure should be capable of conveying a 1:100 yr AEP storm event. The comparable criteria for 'high' hazard structures are 1:100yr AEP and 1:1,000 yr AEP, respectively.

It is expected that new water containment structures would be designed according to industry standard guidelines such as those detailed above.

It is unclear if existing water containment structures on site have been designed for similar criteria or whether such criteria exist for this region. Therefore, the performance of water containment has been assessed by means of water balance. The frequency of simulated overflow at each water containment facility has been summarised in Table 10-5 Chapter 10, replicated below in Table 1. (In the absence of specific results from the water balance that illustrate the annual probability of overflow for comparison with industry guidelines, information was extracted from Goldsim).

Table 1: Simulated percentage days when untreated water overflows to creeks

Pond	Year (% of days overflowing)												
	1	2	3	4	5	6	7	8	9	10	11	12	Max. Spill (m^3/day)
RP1	5.2	8.3	9.5	6.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	329,400
RP2	1.5	2.5	1.9	1.5	0.7	0.6	0.7	0.5	0.7	0.6	0.7	0.7	48,018
RP3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0
RP5	2.3	3.2	2.8	2.4	1.2	1.1	1.2	1.0	1.1	1.1	1.2	1.2	52,036
HLP	6.1	14.6	8.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	9,226

Source: 100 x 12 year sequences generated by Goldsim Model MtToddWB_Production_PFS_45K

The relatively low frequency of overflow suggests that storage and water transfer facilities will be able to contain most rainfall events represented by the climatic record and the alternative stochastic representations of potential rainfall variability. The study assumption is that the frequency of overflow represented by the water balance simulation in Table 10-5 is indicative of that required by containment facilities with a significant hazard rating, and with additional measures such as the temporary transfer of excess water to the TSFs are likely to achieve the design criteria required by high hazard structures.

1.3 The exceptional circumstances in which retention ponds are expected to overflow

Indications from water balance simulations are that water containment and transfer facilities have been designed to prevent overflow during moderately large rainfall events (with an AEP of up to 1 in 50 yrs) and possibly larger events, should additional emergency transfer measures be put in place. The circumstances during which retention ponds could overflow comprise storm rainfall events of greater severity (typically in excess of 1:50 yr AEP) or when transfer facilities (pumps, pipelines and treatment plant) remain inoperative over extended periods (typically multiple days).

1.4 Justification for the risk rating of medium for risks SWOI, SW02 and SW04 (and SW03);

Consequences should be similar for all three sources as they involve a discharge to the downstream environment. SW03 and SW04 would have higher consequences because they are essentially catastrophic failures, whereas SW01 and SW02 would occur after some prior warning of pending rainfall.

Likelihood varies largely due to the failure being caused by inadequate capacity (SW01 and SW02) rather than design/structural failure (SW03 and SW04).

Residual impacts are similar for all sources as their mitigation requires close monitoring and additional actions to reduce risk. Also, it is assumed that the impacts will include off-site impacts.

Table 2 below is a detailed risk assessment of surface water risks SW01 - SW04 from the draft EIS.

Table 2 Risk Rating for Surface Water

Reference	Consequence	Likelihood	Residual
SW01	3 Minor off site impacts due to reduced overflow by increased and temporary transfer to TSF or if no transfer possible then overflow will be diluted by downstream watercourses which would be elevated due to higher than normal rainfall	2 to 3 Water balance results suggest the event might occur during the earlier years of production (The event is likely to occur once every 2 – 5 years) whilst the event could occur at some time during later years (The event is likely to occur once every 5 – 10 years).	H These are likely to exceed the risk acceptance threshold and although proactive control measures have been planned or implemented, requires a close monitoring regime and additional actions towards achieving further risk reduction is required. e.g. emergency transfer to TSF and additional pump capacity.
SW02	3 If no capture and transfer possible then overflow will be diluted by downstream watercourses which would be elevated due to higher than normal rainfall	2 to 3 Water balance results suggest the event might occur during the earlier years of production (The event is likely to occur once every 2 – 5 years) whilst the event could occur at some time during later years (The event is likely to occur once every 5 – 10 years).	H These are likely to exceed the risk acceptance threshold and although proactive control measures have been planned or implemented, requires a close monitoring regime and additional actions towards achieving further risk reduction is required. e.g. capture and emergency transfer to TSF and additional pump capacity.
SW03	4 Similar effect to SW01 but with less dilution potential due to increased volume of outflow following catastrophic failure which could occur during dry weather conditions.	1 Due to recognised industry design standards of construction	H Same as SW01 and SW02. Also, cause major off-site impacts.
SW04	4 Similar effect to SW01 but with less dilution potential due to potential for prolonged volume of discharge from ponds.	1 Due to regular checks and maintenance?	H Same as SW01, SW02 and SW03. Also, no major alternative treatment option.