Appendix B

Technical memorandum – water recycling plant process and OEH licence limits

MWH

BUILDING A BETTER WORLD

TECHNICAL MEMORANDUM

TO: Craig Harris - CIC Australia

DATE: 19 January 2011

CC:

REF: A1081404

FROM: MWH

MWH Australia Pty Ltd

SUBJECT: Googong Township – Water Cycle Project – Environmental Assessment Responses

This memorandum has been prepared as a response to the comments of the Department of Environment, Climate Change and Water (DECCW) dated 21st Decmeber, 2010. The comments of DECCW have been review by MWH and areas applicable to the concept design are noted in this document.

The proposed effluent quality for environmental discharge has highlighted by DECCW. The parameters which have been altered by DECCW from the original concept design are outlined in Table 1. All DECCW proposed discharge conditions are achievable where plant operating staff are sufficiently experienced in maintaining efficient plant operation.

Table 1: Parameters which vary between concept design and DECCW recommendations

Parameter	DECCW proposed discharge (90^{th} percentile)	Proponents proposed limit (90^{th} percentile)
Suspended Solids	10 mg/L	20 mg/L
Total Nitrogen (TN)	10 mg/L	15 mg/L
Total Phosphorous (TP)	0.5 mg/L	0.5 mg/L
Total Dissolved Solids (TDS)	700 mg/L	700 mg/L
Faecal Coliforms	200 cfu/100mL	No proposed limit
pH	6.5 – 8.5	No proposed limit
Free Chlorine Residual	0.1 mg/L	No proposed limit
Nitrogen – Ammonia	2 mg/L	No proposed limit
Oil and Grease	2 mg/L	No proposed limit

Suspended Solids

The suspended solids concentration of 10mg/L (90^{th} percentile) is expected to be achieved by the current MBR design.

Total Nitrogen

Reducing the 90^{th} percentile limit for TN is achievable but will potentially increase operating costs.

The MBR design comprised of a 5-stage Bardenpho reactor design, followed by membrane separation. The limit of 10mg/L in the 90^{th} percentile may be achieved using the 5-stage Membrane Bioreactor (MBR) technology, currently proposed. 5-stage Bardenpho technology allows for full nitrification and denitrification, allowing a very low effluent TN concentration.

Mass balance modelling was completed in during the concept design stages and a plant capability statement was issued to CIC Australia dated the 29th Sept, 2009. Modelling showed that the expected average TN concentration was 5.9 mg/L. Hence, it is expected that the WRP will be able to achieve the TN limits of 7mg/L and 10mg/L in the 50th and 90th percentiles, respectively.

Experienced operational staff are essential to achieving the minimum possible output TN concentration. Previous experience has shown that operating a Bardenpho plant achieving the design effluent condition will be difficult without a good fundamental knowledge of the processes involved. This may have an impact on operational costs in the form of additional training or operator supervision.

In order to improve the TN performance (to 10mg/L 90th %ile), additional "carbon dosing" may be required. This additional carbon will enter the system as acetic acid dosing. This may result in a significant increase in the overall operating costs in the form of increased chemical costs.

Total Dissolved Solids

The TDS limit which has been proposed will only be achievable where biological phosphorous removal is utilised. Furthermore, the mass balance which predicts TDS concentration is based on a assumed inlet water salt concentration from domestic waste. If the level of salt is above the assumed input, the TDS requirement may not be achieved.

Faecal Coliforms

The recycled water specification was set as a faecal coliform concentration of 1 cfu/100mL. The current plant design specifies that all flows shall pass through disinfection. Hence, the faecal coliform limit of 200 cfu/100mL will be comfortably achieved.

Free Chlorine Residual

Small changes to the design configuration of the plant discharge arrangement and/or network will be required to meet the DECCW proposed 90th percentile free chlorine limit of 0.1 mg/L. We have identified two ways of meeting the licence requirement

In the current design, disinfection in the transfer pipeline has been designed to ensure a free chlorine residual of 1mg/L at the downstream end of the pipeline. This ensures that the appropriate "CT" value of Concentration x Time of treatment is achieved, as described in the MWH concept design report. The free chlorine concentration leaving the "Chlorine Contact Tank" (ie the pipeline), in the modelled scenario, will be approximately 1 mg/L. This is well in excess of the DECCW proposed 90th percentile limit of 0.1 mg/L.

The environmental water release strategy must be reviewed in order to achieve the DECCW recommendation of 0.1mg/L. Two options may be considered, de-chlorination using sodium bisulphite (SBS) or removal of the chlorination step for water which is to be sent to the environment.

1. De-chlorination

SBS may be used to bind free chlorine in the systems to a state where it is chemically inert. This SBS step is normally used for treatment plants that use chlorine for disinfection, then discharge to a river or stream. Introducing SBS will involve the design and construction of a chemical dosing facility at each of the environmental discharge locations. The current design shows a discharge point into

stowmwater pond 1 for the early years of operation, and then a second release point at the top of Pond 4 once the full recycled water system is constructed.

Utilising SBS will allow for the currently proposed discharge locations to be maintained, without the need for additional transfer pipelines.

The dosing rate for de-chlorination is expected to be in the order of 5 kg of SBS solution per mega litre of water discharged to the environment. A schematic of the proposed SBS dosing scheme is given in Figure 1.

The ownership and operation of dosing outside of the plant may cause difficulties. For example, the specific location of the sample point must be considered in detail. The licence sample point must be located at Basin 4, in order for de-chlorination to be conducted at the Basin 4 discharge point. Utilising an off-site sample point may present significant operational difficulties in plant operation due to any changes in water quality, including any of the licence parameters, within the transfer pipeline. This issue must be considered further in choosing a de-chlorination option.

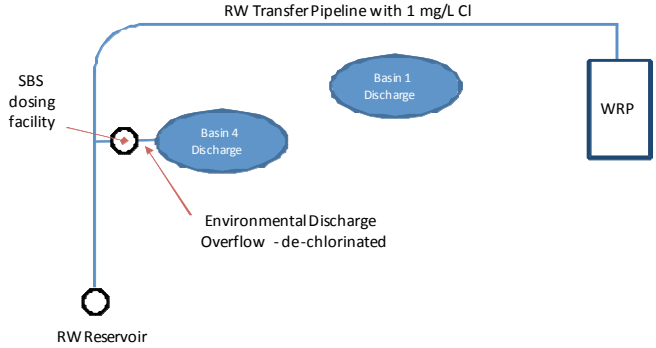

Figure 1: Schematic of environmental discharge to Basin 4, utilising SBS dosing for de-chlorination.

2. Removal of Chlorine dosing for environmental discharge

The WRP has been configured with two stages of disinfection (UV then chlorine) to meet the strict requirements of the risk-based recycled water guidelines. However, releases to the environment do not require such a high standard of disinfection. Hence it may be preferable to split the treatment at the final stage to two streams, one for the recycled water system and the other for environmental releases.

The chlorination stage may be removed from the treatment process for flows which are discharged to the environment only. All flows which are to be used for recycling will require chlorination. This approach will require the physical separation of flows for water re-use and flows for environmental discharge.

Flows from the WRP which are above the requirement for RW use, will bypass chlorination at the WRP, as instructed by the plant flow control system. The flow which bypasses chlorination will be transferred to an environmental discharge point at Basin 1, via a dedicated pipeline. This option will require the provision of a second transfer pipeline, adding to the overall plant capital costs. The second pipeline will be required at all stages where RW is produced, as a dedicated conduit will be required for all non-chlorinated water. A schematic of the proposed pipeline configuration is given in Figure 2.

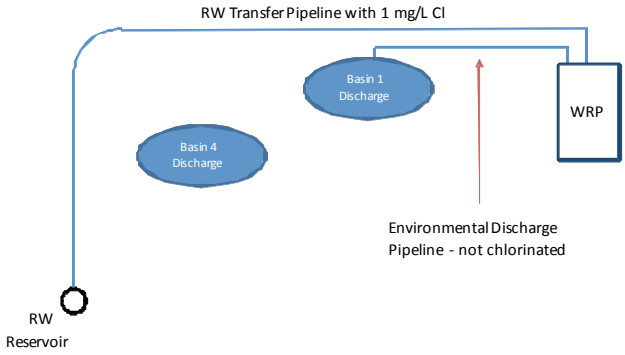

Figure 2: Schematic of environmental discharge strategy to Basin 1, where the discharged volume is not chlorinated

The DECCW recommended environmental discharge limit for faecal coliforms is 200 cfu/100mL. This is may be achieved by a combination of secondary treatment, membrane filtration (in the MBR) and UV disinfection. Hence, chlorination is not essential for the environmental discharge of plant effluent, in order to meet the recommended discharge quality.

Algae production may cause significant issues where plant effluent is discharged without chlorination. It is not expected that UV treatment alone will prevent the growth of algae in the receiving water course. Algal growth may be most problematic during periods of dry weather, creating a significant impact on the Basin 1 discharge location and downstream waterways.

Nitrogen – Ammonia

The 5- stage Bardenpho rector which has been design is expected to achieve full nitrification. This ensures that all ammonia may be converted to nitrate. Hence, the effluent condition of 2mg/L (90th percentile) may be achieved by the current design.

Oil and Grease

The current design is expected to achieve 2 mg/L of oil and grease. This reduction will be achieved by the membrane filtration process.

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