



Memorandum

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Department of
**Science, Information
 Technology and Innovation**

2/03/2017

To:	Alison O'Brien, Senior Environmental Officer Minerals Business Unit, Department of Environment and Heritage Protection
Assessed by:	Dr Siobhan Rigby, Senior Scientist Water Assessment and Systems (WAS), Environmental Monitoring and Assessment, Science Delivery (EMAS), Department of Science, Information Technology and Innovation (DSITI)
Checked by and provided through:	Damian Lovejoy, Team Leader

Subject: Environmental Authority Amendment Application for the Mourilyan Harbour Facility

Further to your work request dated 20th February 2017, the Water Assessment and Systems (WAS) group has reviewed the Environmental Authority Amendment Application in relation to the Mourilyan Harbour Facility proposed by Tablelands Mining Group, located in North Queensland. The specific information provided for the review included:

- "Environmental Authority Amendment Application for the Mourilyan Harbour Facility January 2017" saved as "15_018_Mourilyan Harbour_EAAA_SW_January 2017.pdf" prepared for Tablelands Mining Group by Northern Resource Consultants Pty Ltd;
- "Compliance Database_Mourilyan (Final).xls"
- "Port of Mourilyan_Raw Data_Aluminium"

The proponent has proposed an amendment to the current Environmental Authority (EA) conditions, including;

- (1) Reduced frequency of water quality monitoring from monthly to quarterly at all up current/upstream and down current monitoring locations.
- (2) Increased water quality contaminant limit in the receiving environment for dissolved Aluminum from 0.5 µg/L to 57 µg/L, and
- (3) The removal of an EA water quality monitoring point MW4 (upstream of treatment plant discharge),

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General Comments:

This response focuses largely on surface water and aquatic ecosystem health aspects of the proposal. This advice is based on Schedule 1 of the *Environmental Protection (Water) Policy 2009* (EPP (Water)), the *Queensland Water Quality Guidelines 2009* (DEHP 2013a), the Queensland Government's Technical Guideline for Licensing - *Wastewater release to Queensland waters* (DEHP 2012), and application of relevant guidelines such as the *Australian and New Zealand Guidelines for Fresh and Marine Water Quality* ANZECC & ARMCANZ (2000a,b,c).

Overall, there was insufficient information to assess the proposal to increase water quality contaminant criteria in the receiving environment for dissolved aluminum from 0.5µg/L to 57µg/L. Further raw data, supporting information, statistical analysis and QA/QC justification would be required from the proponent to derive a locally relevant trigger value (LRTV) in line with the procedures outlined in the QWQGs (2009) and AWQG (200a). The AWQGs (2000a) list a low-reliability environmental concern level of 0.5µg/L for dissolved aluminum, however, since this time a water quality guideline of 24 µg/L aluminum has been developed by Golding et al (2015). Detailed explanation of the identified issues with the proponents' methodology and recommendation are provided in the Specific Comments section below.

In regards to the proposal to reduce the frequency of water quality monitoring from monthly to quarterly at locations listed in the EA. This may be appropriate in the treatment/onsite locations (MW1, MW2 and MW3) as monitoring occurs at the start of a discharge event, daily and then weekly during discharge. In relation to receiving water locations, and relevant to the discussion of variability of aluminum monitoring results, it is recommended that monthly sampling continue if the proponent wishes to derive locally relevant trigger values (LRTV) and to ensure that the receiving waters are characterized with best available limit of reporting, even when discharges are not occurring. This will provide further characterization of seasonal variability.

In regards to the removal of compliance monitoring at MW4, DSITI considers that this may be appropriate to remove from compliance monitoring under the justification provided by the proponent that this sampling location is upstream of their discharge point in a storm water drain. The proponent has suggested that they will remain undertaking analysis for the prescribed indicators at MW4 in order to assess the relative influence of their discharges in relation to discharges occurring to this drain upstream. This is also supported by DSITI

Specific Comments

1.1 Derivation of Dissolved Aluminium Locally Relevant Trigger Value (LRTV) for the Receiving Environment according to the AWQGs (2000a) and QWQGs (2009).

Issue 1: Methodological concerns regarding the derivation of locally relevant trigger value for dissolved aluminium.

Incomplete Data Set

An incomplete data set for dissolved aluminium at sites labelled “upstream” has been used in the LRTV derivation process presented in Table 7, p 13. The data date range used is between 10th September 2015 and 29th October 2016. However, from the files provided these monitoring sites have additional aluminium data ranging back to 10th January 2015 (plus a single data point of collection from March 2014). Five sampling occasions have not been included in the statistical analysis and no explanation is provided to justify the exclusion of this monitoring data. All relevant, QA/QC’ed, vetted and verified monitoring data should be used in the derivation of LRTVs in accordance with the AWQGs and QWQGs. Where data is excluded there should be an explanation for the justification.

Analytical Sensitivity

Laboratory limit of reporting (LOR) concerns have been identified by the proponent (Figure 1). These issues are important considerations not only for compliance but also for the development of dissolved aluminium LRTV for Mourilyan Harbour

Limit of Reporting and Practical Quantification Limit

Review of data collected as part of the TMG REMP has highlighted that compliance with the EA contaminant limit aluminium cannot be assessed due to limitations to for LOR capabilities at NATA accredited laboratories. The limit of reporting for analysis conducted by NATA accredited laboratory SGS prior to January 2016 was 50µg/L. Arrangement was sought with SGS to reduce LOR for aluminium detection in marine waters with a 10µg/L limit achieved from January 2016 onward.

LOR is noted to be well above the water quality limit of 0.5µg/L detailed in Condition W5 – Table 5 of the EA. NRC has been in contact with the SGS Business Manager (based in Cairns) and it has been confirmed that the lowest detection limit (PQL) for dissolved aluminium in saline water is 5µg/L. SGS have also indicated detection below this limit is not available with ALS Environmental and it is unlikely any laboratories in Australia would be able to report below this limit.

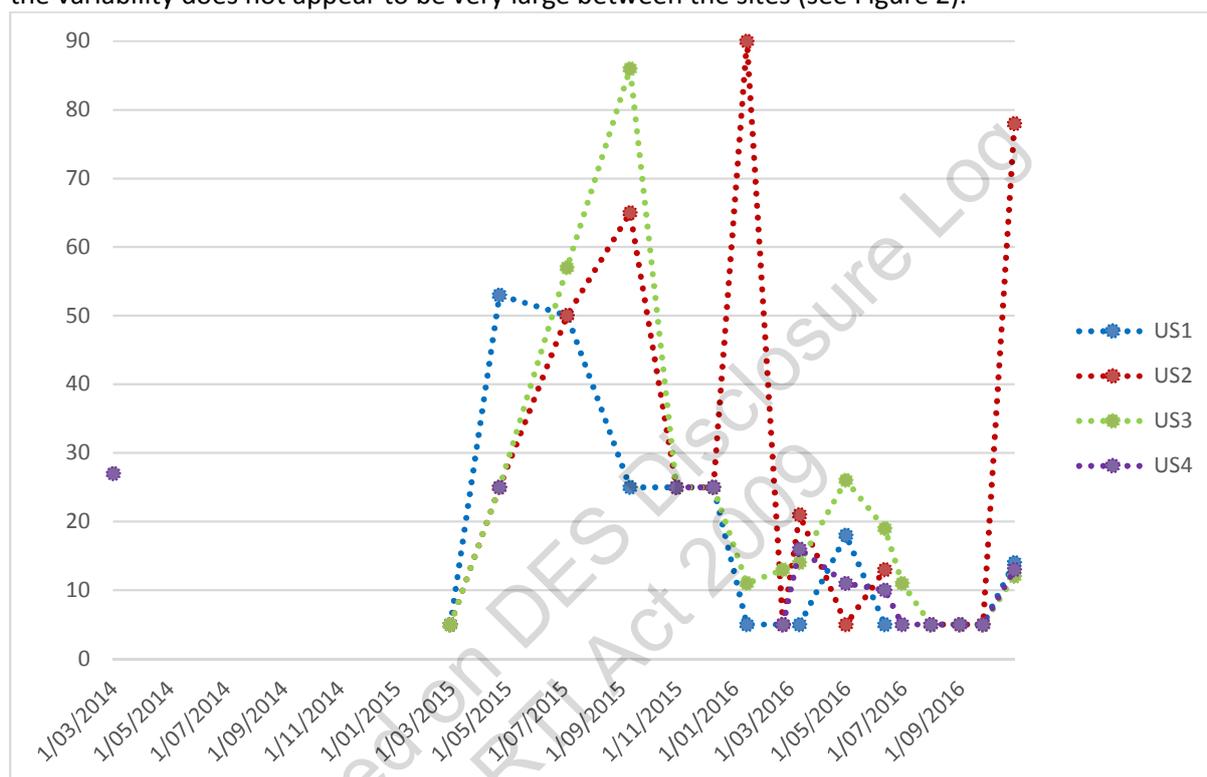
Figure 1. Excerpt from page 12 of Mourilyan Harbour Environmental Amendment Application – Surface Water January 2017

The best available dissolved aluminium practical quantification limits available at commercial laboratories range between 0.5-5 µg/L in saline water. Approximately a quarter of the “background” aluminium data collected by the proponent has been analysed using less sensitive laboratory techniques with a LOR of 50 µg/L. A LOR of 50 µg/L is substantially above the current receiving environment EA criteria value of 0.5 µg/L as well as the toxicity water quality guideline established by Golding et al (2014) of 24 µg/L. The usefulness of data collected using less sensitive laboratory methods is diminished in the LRTV derivation process. Regardless of how the 50 µg/L LOR is managed: assumed as half LOR, full LOR or ‘0’, it has a significant impact on the distribution of the dataset, and resultant percentile LRTV calculations. Ongoing monitoring should utilise the best available laboratory methods.

Statistical analysis

The proponent has elected to assume the LOR as '0' for the statistical analysis of the dissolved aluminium LRTV dataset. While this choice will invariably reduce the 80th percentile compared to assuming full LOR (i.e. a more conservative approach) it also artificially increases the variability of the dataset. The proponent uses the resulting high data variability to support adding 2x Standard Error value to the 80th percentile which results in the proposal for a 57 µg/L aluminium. This approach is not supported.

In terms of the data variability between the sites US1, US2, US3, and US4, the proponent should prepare box plots when a future data set is compiled in line with the DSITI recommendations. Certainly the variability does not appear to be very large between the sites (see Figure 2).



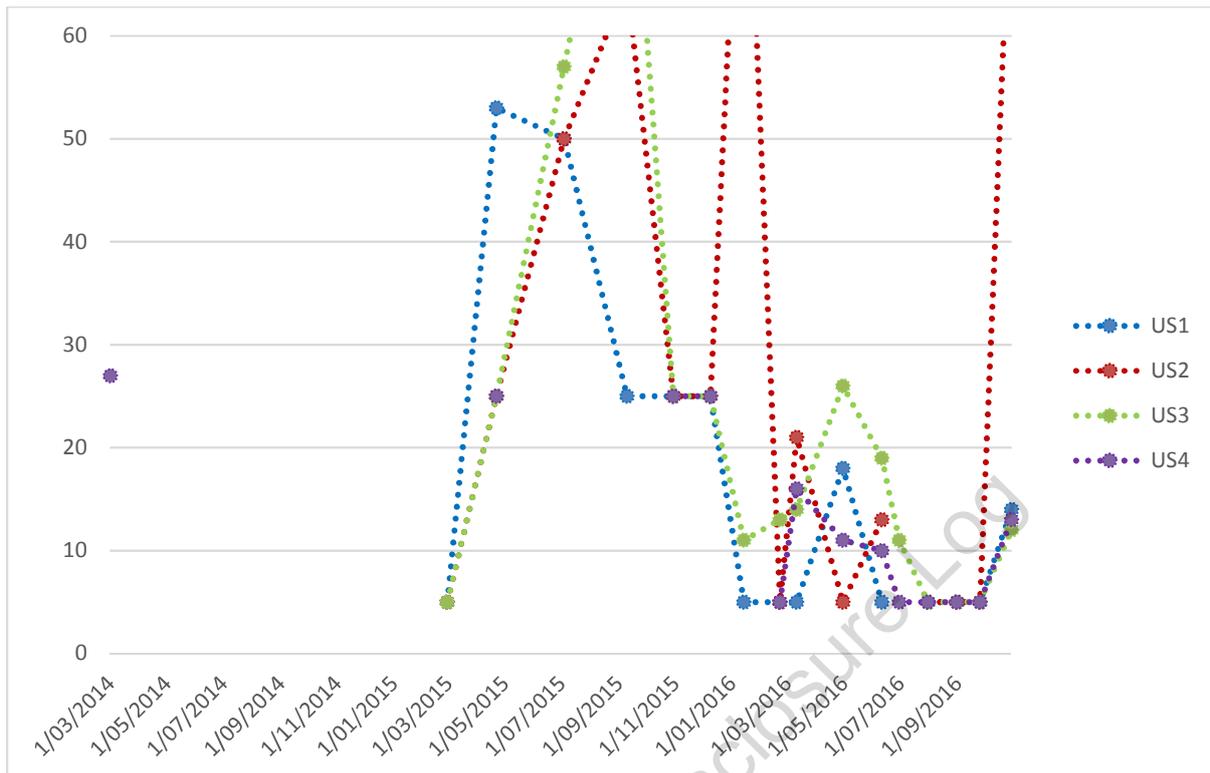


Figure 2. Time series dissolved aluminium concentrations ($\mu\text{g/L}$) at upstream locations of Mourilyan Harbour. (A) Y axis at $90 \mu\text{g/L}$ (B) Y axis at $60 \mu\text{g/L}$. Assumptions: Data QA/QC'ed, Half LOR.

The variability appears to be temporal rather than geographical in nature. Since January 2016 (once the LOR improved) there was only 1 occasion where the measured level of dissolved aluminium is higher than the toxicological water quality guideline of $24 \mu\text{g/L}$ (for all upstream data, including REMP data, provided so far). Without further information to assist in the interpretation it is difficult to speculate regarding the reason for variability with time. Perhaps seasonal or tidal impacts (or potentially influence from discharges) are important influential factors but this is not evident from the data provided.

The process for deriving LRTVs for Mourilyan Harbour should incorporate descriptions of influences from tides or discharge of stormwater from Mourilyan Harbour etc. in the vetting process for data points. This process, including the justification for excluding data, should then result in a dataset assumed to be representative of "background" water quality from which summary statistics can follow. While all of the upstream sites are located outside the mixing zone, it is still important to assess the upstream data alongside discharge timeframes, discharge aluminium concentrations etc. to ensure that data is not assumed to be "background" where influences from discharge may potentially be relevant in this complex open coastal location.

QA/QC

No comments relating to verification of QA/QC of the data included in the LRTVs dataset is made in the application. Only data with a high degree of confidence should be included in the LRTV derivation process while data which has not been assessed for QA/QC should be excluded.

Recommendation 1:

DSITI agrees that the current criteria of $0.5 \mu\text{g/L}$ for dissolved aluminium should be amended in the Mourilyan Harbour Environmental Authority. However, the proposal for $57 \mu\text{g/L}$ is not supported due to the concerns outlined above. WAS has concerns about the limited dataset available for deriving an

interim aluminium trigger value but nevertheless suggest applying the Golding et al (2014) guideline of 24 µg/L as an interim value while collection of sufficient background data is undertaken.

If the Golding et al (2014) guideline is selected please note that while the guideline is defined as a total aluminium guideline officially, the complex nature of aluminium speciation and toxicity in marine environments means that the guideline value (24 µg/L aluminium) should be compared to the dissolved aluminium raw monitoring data in terms of compliance and impact assessment, and hence the criteria value can be listed as a dissolved criteria.

If the 24 µg/L criteria is applied retrospectively to assist our analysis of both the upstream and downstream data provided (for DS1, DS3 and US1, the compliance monitoring locations) we find that since the LOR was improved to 10 µg/L (i.e. since January 2016) only 3 "exceedances" at DS3 (MW6) would have occurred, and that two of these "exceedances" are relatively close to the toxicity criteria level, namely 26 and 27 µg/L. We have no information regarding the discharge timing or water quality for this site so further interpretation of this retrospective analysis is not possible. Importantly, the upstream compliance monitoring point (US4) does not register any exceedances using this retrospective approach with the data provided since the EA came into effect.

It is possible to establish an interim and speculative dissolved aluminium criteria with the limited upstream data set since LOR improvement (between January-October 2016). This may be useful to inform future discussions with the proponent however the considerations of QA/QC, discharge influence, and minimum sample numbers (and sampling duration period) have not been adequately met or included in this interim analysis and hence this number should not be applied as a LRTV or applied in the EA without further consideration, justification, data collection and assessment by the administrating authority. The 80th percentile of pooled upstream data (10 sampling occasions) is 14 µg/L, while the 95th percentile is 36 µg/L. When all provided upstream data is used to calculate an 80th percentile, even when the LOR was 50 ug/L, the interim LRTV is 25 µg/L. Hence, the toxicity guideline of 24 µg/L is a reasonable guideline to apply until the proponent can establish LRTVs according to the requirements of QWQGs, AWQGs and the advice from DSITI.

Cited plus Useful References

The National Water Quality Management Strategy website, Department of the Environment, Australian Government.

<http://www.environment.gov.au/water/policy-programs/nwqms/index.html>

AWQG (2000a) or ANZECC & ARMCANZ (2000a). *Australian and New Zealand Guidelines for Fresh and Marine Water Quality – Volume 1: The Guidelines*. National Water Quality Management Strategy (NWQMS). Australian and New Zealand Conservation Council (ANZECC), Agriculture Resource Management Council of Australia and New Zealand (ARMCANZ). Commonwealth of Australia, Canberra:

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Amendments:

Golding, LA, Angel, BM, Batley, GE, Apte, SC, Krassoi, R and Doyle, CJ (2015). *Derivation of a Water Quality Guideline for Aluminium in Marine Waters*. Environmental Toxicology. Environmental Toxicology and Chemistry, Vol. 34, No. 1, pp. 141–151

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DEHP (2012). *Technical guideline - Licensing - Wastewater release to Queensland waters (121218; EM112; Version 1*. Department of Environment and Heritage Protection. 18 December 2012. Queensland Government, Brisbane.

<http://www.ehp.qld.gov.au/licences-permits/business-industry/pdf/wastewater-to-waters-em112.pdf>

DEHP (2013a). *Queensland Water Quality Guidelines, Version 3, ISBN 978-0-9806986-0-2*. Department of Environment and Heritage Protection (DEHP), Queensland Government, Brisbane:

<http://www.ehp.qld.gov.au/water/pdf/water-quality-guidelines.pdf>

DEHP (2013b). *Monitoring and Sampling Manual 2009, Environmental Protection (Water) Policy 2009, Version 2 September 2010 (July 2013 format edits)*. Department of Environment and Heritage Protection (DEHP), Queensland Government, Brisbane.

<http://www.ehp.qld.gov.au/water/pdf/monitoring-man-2009-v2.pdf>

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