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22 April 2021

Lauren Evans
A/Director Resource Assessments
Department of Planning, Industry & Environment
12 Darcy Street
Parramatta NSW 2124

Dear Lauren,

RE: MOUNT PLEASANT OPTIMISATION PROJECT (SSD – 10418) – RESPONSE TO IESC ADVICE

I refer to the Independent Expert Scientific Committee on Coal Seam Gas and Large Coal Mining Development's (IESC's) advice to the to the Department of Planning, Industry and Environment (DPIE) regarding the Mount Pleasant Optimisation Project (SSD-10418), dated 15 March 2021.

MACH Energy's response to each of the IESC's comments is provided in Enclosure 1.

Yours sincerely,

Chris Lauritzen
General Manager - Resources Development
Mount Pleasant Operation

ENCLOSURE 1

MACH ENERGY RESPONSE TO IESC COMMENTS

Mount Pleasant Optimisation Project
Response to IESC Comments

Comment	IESC Comment	Response
1	Overall, the surface water assessment reasonably predicts potential impacts on surface water resources, although the water balance model appears not to have been calibrated or validated to monitoring data. However, several areas require further data and clarification.	Noted – responses to specific IESC comments are provided below. Refer to response to IESC comment 7 regarding water balance model calibration.
2	The IESC notes that discharge dam DW1 will be constructed for controlled releases and is planned to be commissioned in early 2022. The proponent has described the location of the dam to be west of Bengalla Road; however, they have not shown the location of the dam discharge point into the Hunter River (HEC 2020, p. 49). This location should be clearly identified to assist in assessing if the current Hunter River monitoring sites are still sufficient to assess any potential impacts.	The approved discharge dam (DW1) is shown on Figures 3-4 to 3-10 of the EIS. DW1 will discharge to a tributary with scour protection, which joins the Hunter River at a point upstream of the existing surface water monitoring site (W15) (refer Figure 7-20 of the EIS). Various existing monitoring sites on the Hunter River are also located upstream of the confluence with the tributary. Accordingly, the existing monitoring sites are considered to be sufficient for the purposes of assessment and ongoing monitoring.
3	The predicted average EC (electrical conductivity) of release waters to the Hunter River from DW1 is 739 µS/cm based on the median model results. Although this exceeds the default guideline value of 350 µS/cm for upland rivers in NSW (HEC 2020, p. 27), it is within the range of EC values recorded in the Hunter River upstream of the MPO (GS 210056), of which 70% of values exceed the guideline.	Noted.
4	Based on the predicted total release volume, the average EC of overflow from the sediment dams to Rosebrook Creek is 394 µS/cm (HEC 2020, p. 78). Although this exceeds the default guideline value, HEC (2020, p.78) states that it is within the range of baseline EC values recorded for local and regional surface water systems (HEC 2020, Section 3.5).	Noted.

Comment	IESC Comment	Response
5	While the IESC commends the proponent for predicting contaminant concentrations to be released into the Hunter River (including Al, Li, Mn and turbidity), these were based on only three samples from the mine water dam. Additional data will need to be collected from on-site storages, as well as upstream and downstream of the discharge site to confirm these predictions.	Discharges at the Mount Pleasant Operation (including the Project) would be undertaken in accordance with the Hunter River Salinity Trading Scheme and EPL 20850, which are administered by the NSW Environment Protection Authority. MACH notes the IESC's endorsement of the approach used to predict potential water quality of future releases to the Hunter River in accordance with the Hunter River Salinity Trading Scheme. MACH is continuing to periodically collect metals data from the mine water management system. Additional sampling events have been conducted since the Surface Water Assessment was finalised, which indicate that metals concentrations are generally consistent with the previously collected data used in the assessment. Review and progressive refinement of the site water balance would continue to be undertaken periodically over the life of the Project to record the status of inflows (water capture), storage and consumption and to optimise water management performance (including discharges). MACH would continue to periodically collect water quality data from the mine water management system over the life of the Project to inform the review and refinement of the site water balance model. The results of this would be reported in the Annual Review.
6	Disposal of sediment from sediment dams after removal has not been outlined, and details should be provided on the disposal and management of excess sediment waste.	The management of erosion and sediment controls, including sediment dams, is described in the Mount Pleasant Operation Water Management Plan. Standard erosion and sediment control techniques are designed and operated in accordance with the requirements of *Managing Urban Stormwater: Soils and Construction Volume 1* (Landcom, 2004) and *Volume 2E - Mines and Quarries* (DECC, 2008). The Mount Pleasant Operation Water Management Plan includes an Erosion and Sediment Control Plan. The Erosion and Sediment Control Plan states the following with regard to management of sediment dams: *Environmental and sediment dams that have the potential to spill to the environment will be inspected monthly and immediately after rainfall events with more than 20mm in 24 hours. Dams will be inspected for capacity, structural integrity and effectiveness. Where inspections indicate substantial accumulation of sediment in a sediment dam, clean-out will be undertaken as soon as practicable so as to reinstate the minimum required volumes.* Any accumulated sediment would be disposed of in-pit or in the Eastern Out-of-Pit Emplacement. The existing Water Management Plan would be reviewed and revised to incorporate the Project subject to the conditions of any Development Consent for the Project.

<table>
<tr><th>Comment</th><th>IESC Comment</th><th>Response</th></tr>
<tr><td>7</td><td>Water management is simulated using the Goldsim model, a tool which is commonly used by the mining industry and is considered well suited for such purposes. Rainfall runoff in the water balance model was simulated using the Australian Water Balance Model (AWBM) (Boughton 2004, cited by HEC 2020, p. 60). The AWBM is a nationally recognised catchment-scale water balance model that estimates catchment yield (flow) from rainfall and evaporation. Although this water balance model is based on reasonable assumptions, no discussion is provided on how the parameters were derived (Table 22, HEC 2020). It would also appear that no calibration or validation of model performance was undertaken using water-level monitoring data from the existing water management system.</td><td>As identified by the IESC, the water balance model is based on reasonable assumptions. These assumptions have been informed by significant experience of site water balance modelling at other mining operations in the Hunter Valley.
Site-specific calibration of the site water balance model was not considered appropriate, given:
• The Mount Pleasant Operation water management system has been progressively developed since construction began in October 2016 and the various water storages and their catchments evolved rapidly during this commencement phase (i.e. altering areas of natural, construction and operational surfaces within individual dam catchments).
• A prolonged drought significantly reduced the opportunity to gather additional site-specific runoff and catchment data sets.
MACH Energy would undertake a calibration of the site water balance model once sufficient water management system data has been collected to provide useful additional calibration points under median and high rainfall conditions. The process to periodically conduct model calibration would be documented in the updated Water Management Plan for the Project.</td></tr>
<tr><td>8</td><td>The proponent has provided several modelled outcomes for various scenarios, including river extraction, rainfall and on-site sediment dam overflows, for either 5% or 95% chance annual exceedance events. However, modelled outcomes of potential overflow events for 5%, 2%, 1% and 0.1% chance AEP events should also be presented to indicate that there will be no potential impacts due to overflow or breaching of the sediment dams. The proponent has not done a formal sensitivity analysis, but has assessed the distribution of outcomes based on shifted sequences of historical climate (HEC 2020, App. D, Section 6).</td><td>The conceptual design of the proposed sediment dams has been undertaken in accordance with the Landcom (2004) and DECC (2008) guidelines. These guidelines provide for sediment dams to overflow (or discharge) when rainfall exceeds the design criteria of the dams. Further assessment of the performance of the sediment dams under more extreme rainfall events (i.e. 2%, 1% and 0.1% AEP) is not required, as these dams are not designed to contain these rainfall events under the relevant guidelines.
The Mount Pleasant Operation Water Management Plan includes an Erosion and Sediment Control Plan. The Erosion and Sediment Control Plan states the following regarding the management of environmental and sediment dams following significant rainfall events:
Environmental and sediment dams that have the potential to spill to the environment will be inspected monthly and immediately after rainfall events with more than 20 mm in 24 hours. Dams will be inspected for capacity, structural integrity and effectiveness. Where inspections indicate substantial accumulation of sediment in a sediment dam, clean-out will be undertaken as soon as practicable so as to reinstate the minimum required volumes.
The existing Water Management Plan would be reviewed and revised to incorporate the Project, subject to the conditions of any Development Consent for the Project.</td></tr>
<tr><td>9</td><td>The proponent predicts outcomes of several climate-change scenarios on surface water levels (Table 31) (HEC 2020, p. 82), and states (without modelling) that there would be “lower rainfall and higher evapotranspiration conditions than the Representative Concentration Pathway (RCP) 4.5 scenario, that would result in the final void water level being lower again (i.e. further reducing spill risk)” (HEC 2020, p. 82). From the results presented, it seems reasonable to conclude that climate change will not increase the risk of spills from the remaining voids under a notional worst-case scenario.</td><td>Noted.</td></tr>
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Comment	IESC Comment	Response
10	The proponent has developed a 3D numerical model using MODFLOW-USG to assess the impacts from the project (AGE 2020, p. 77). This is an appropriate model to assess the potential impacts from this project.	Noted.
11	The proponent states that the throw from the Mount Ogilvie thrust fault has resulted in a displacement of 100-200 m below Sandy Creek (AGE 2020, p. 26) and, due to the resultant juxtaposition of sediments, it is used as a no-flow boundary. However, only part of the Mount Ogilvie thrust fault is co-incident with the no-flow boundary (AGE 2020, Appendix A, Figure A2.1). Further justification for the no-flow boundary on the western side of the model domain should be provided, including any potential influence on the modelled results.	AGE has advised that the western groundwater model boundary was assigned as a no-flow boundary due to the following reasons: • the coal seams targeted by the Mount Pleasant Operation (incorporating the Project) are at significant depth along the western and south western model boundary and overburden pressure is expected to reduce the cleat aperture and permeability of the coal seams significantly; and • the southern portion of the western boundary extends beyond (further west of) the Ogilvie Fault to encompass the shallow alluvial systems as these are not influenced by the fault. This allows any potential impacts to propagate further than the fault line. The no-flow boundary was applied as it is expected flow in the shallow layers would be largely perpendicular to the boundary with a southerly flow direction, making no-flow the most appropriate boundary condition. It is noted that the predicted cumulative impacts have interacted with the western model boundary at depth, but this is largely depressurisation occurring where the Ogilvie Fault exists and where the coal seams are deep and tight. It is also noted that at the end of mining the predicted drawdown in the alluvium is situated at least 5 km upstream of the boundary and is not being influenced by the no-flow boundary condition.
12	The assumptions used in the groundwater model, as described in AGE (2020, Section 5.9) are generally appropriate. However, greater confidence in the model predictions could be achieved if justification of the numerical model assumptions were provided. For example, the Permian sediments are considered to be one aquifer system (AGE 2020, p. 69) but further information should be provided by the proponent to support this. Further, no data are provided to confirm the stated lack of groundwater in the Permian interburden or changes in groundwater salinity of the Permian sediments.	Section 5.9 of the Groundwater Assessment describes two aquifer systems in the vicinity of the Project, comprising the alluvium and Permian sediments. However, Section 5.9 further describes the Permian sediments according to the following systems that each have distinct groundwater properties: • weathered bedrock (regolith); • unweathered bedrock (overburden and interburden); and • the coal seams of the Wittingham coal measures. The numerical groundwater model further discretises the above systems into 20 individual model layers with unique groundwater properties. The groundwater properties for each layer have been derived using the groundwater monitoring data described in Section 5 of the Groundwater Assessment and the calibration process discussed in Section A3 of the Numerical Modelling Report (Appendix A of the Groundwater Assessment). Groundwater quality data, including salinity, are presented in Section 5.7 of the Groundwater Assessment. Potential changes in groundwater quality are discussed in Section 8.5 of the Groundwater Assessment.

Comment	IESC Comment	Response
13	The groundwater model was calibrated to a pre-mining steady-state water level and then a transient calibration water level using a total of 114 monitoring sites and mine inflow data for the period 1991 to 2017. The sites generally have good spatial distribution and associated groundwater level time series information. However, the model calibration may be non-unique because of the limited availability of project area-specific hydraulic parameter data and the lack of model-independent checks on recharge and groundwater flow, such as use of environmental water tracer data (OWS 2020).	The potential for non-uniqueness in model parameters was managed through: • Use of an extensive database of hydraulic testwork to constrain model parameters, including data collected for the Mount Pleasant Operation, Dartbrook Mine, Bengalla Mine and Mt Arthur Coal Mine (refer to Section 5.3 of the Groundwater Assessment and Section A2.3.5 of the Numerical Modelling Report). • Calibration of the model to historical groundwater inflows at Dartbrook Mine, Bengalla Mine and Mt Arthur Coal Mine (refer to Section A3.2.5 of the Numerical Modelling Report). • Model verification using data collected post-2017 (refer to Section A3.2.6 of the Numerical Modelling Report). Brian Barnett, in the peer review of the Groundwater Assessment (Attachment 5 of the EIS), states the following regarding model calibration and non-uniqueness: *Calibration was aimed at reproducing measured groundwater heads and estimated pit inflows into the Mount Arthur and Bengalla Mines and into the Wynn coal seam of the Dartbrook Mine and into in the Dartbrook Mine Hunter Tunnel. The model-predicted heads and fluxes provide an excellent representation of the measured heads and inflow fluxes indicating that the model is well calibrated.* *By using both head and groundwater flux calibration data, the non-uniqueness in model parameters can be substantially reduced and the resultant model confidence improved. The approach described in the Appendix represents an appropriate use of available data to constrain model parameters through calibration that uses historical observations at the site and elsewhere in the model domain.*
14	The model has been validated with the available data. However, these data are unlikely to encompass the extreme conditions that may constitute a notional worst-case scenario. The uncertainty analysis is used to evaluate combinations leading to plausible extreme conditions. The proponent should clarify whether the current uncertainty analysis encompasses a notional worst-case scenario.	The groundwater model calibration relied on an extensive groundwater monitoring database, including: • Water level data collected since 1991 (including Mount Pleasant-specific and surrounding mines). • Observed mine inflow data dating back to 2006 (Dartbrook and Bengalla Mines) and 2010 (Mt Arthur Coal Mine). Brian Barnett, in the peer review of the Groundwater Assessment (Attachment 5 of the EIS), concludes the following regarding the model calibration: *I have concluded that the calibration approach and outcomes meet all reasonable expectations (including guiding principles outlined in Australian Groundwater Modelling Guidelines).* Further to the above, and as recognised in the comment 15 from the IESC, a comprehensive uncertainty analysis has been undertaken in accordance with the IESC explanatory note *Uncertainty analysis—Guidance for groundwater modelling within a risk management framework* (Middlemis and Peeters, 2018). Section 9.1 of the Groundwater Assessment describes that the outputs from the uncertainty modelling were processed in accordance with the risk-based calibrated language proposed in Middlemis & Peeters (2018), including the 98th percentile model results, which are described as "Not likely to occur even in extreme conditions". Accordingly, the uncertainty analysis is considered to encompass a notional worst-case scenario. Brian Barnett, in the peer review of the Groundwater Assessment (Attachment 5 of the EIS), concludes the following regarding the uncertainty analysis: *Results of the Uncertainty Analysis are included in Section 9 of the Report. The method provides a comprehensive assessment of parameter uncertainty, is consistent with Barnett et al., 2012, and Middlemis and Peeters, 2018 and is considered to meet current industry standards for uncertainty quantification.*

Comment	IESC Comment	Response
15	An extensive and useful uncertainty analysis, which implicitly includes a routine sensitivity analysis, using a range of valid parameters has been undertaken (AGE 2020, Section 9 and Appendix A, p. 34). The proponent has not reported the sensitivity analysis of the groundwater model. However, it is important for the proponent to thoroughly document the sensitivity analysis and the range of parameters used in both the sensitivity and uncertainty analysis. This uncertainty analysis presents the potential impacts across five probability classes using the methods described in Middlemis and Peeters (2018) to assess: a. mine inflow rate; b. the reduction in baseflow to the Hunter River, Dart Brook and Sandy Creek; c. the indirect take from the Hunter River, Dart Brook and Sandy Creek alluvium; and d. the zone of 2 m drawdown.	Noted – also relevant to response to IESC comment 14. The outcomes of the climate sensitivity analysis are discussed in Section A6 of the Numerical Modelling Report (Appendix A of the Groundwater Assessment).
16	A climate sensitivity analysis has also been undertaken. This involved reducing rainfall recharge by 20% and an increase in evapotranspiration by 8% and is based on the adopted extremes from the GFDL-ESM2M and ACCESS1-0 global climate models (AGE 2020, Appendix A, p. 35). The IESC considers this to be adequate.	Noted.
17	The impacts on privately owned bores are assessed adequately.	Noted.
18	The groundwater model has assessed the impacts from the project in isolation as well as the cumulative impact with the current approved Mount Pleasant Operation, Dartbrook, Bengalla and Mount Arthur mines (AGE 2020, p. 6). Three other mines are within the vicinity of the project and the IESC agrees with the proponent that, for the geological reasons provided (AGE 2020, p. 6), they do not need to be included in the cumulative assessment.	Noted.

Comment	IESC Comment	Response
19	The rate of recovery of groundwater levels has been appropriately investigated through simulations of post-mining conditions over 1000 years. The proponent acknowledges the increasing uncertainty in the predicted results caused by modelling for such a length of time. These results indicate that the groundwater levels will not return to pre-mining levels, with some residual impacts remaining in the Hunter River alluvium and the Permian groundwater levels, the latter driven by the project's final void as well as the Bengalla mine void (AGE 2020, p. 85 and figure 7.5).	Noted.
20	These assessments adequately differentiate groundwater and water quality impacts due to the project, historical mining already undertaken and currently approved operations (i.e. mining yet to occur). However, the cumulative impacts of the project on flow regimes of streams outside the project area are less comprehensively described. This is important because changes to ecologically relevant components of flow regimes (see Paragraph 22) may have greater impacts on aquatic biota and ecological processes than minor (<5%) changes to total flows, especially in ephemeral streams.	Refer to response to IESC Comments 22 to 24 for a detailed response regarding potential impacts on flow regimes and environmental flows for streams more distant from the Project.
21	Overall, the proponent has used appropriate groundwater and surface water modelling to predict potential incremental (project only) and cumulative hydrological and hydrogeological changes (e.g. drawdown). However, there is no comprehensive assessment of the likely impacts of these changes on water quality, GDEs, riparian vegetation and aquatic biota (including fish passage) along Sandy Creek or other creeks (e.g. lower reaches of Rosebrook Creek) downstream of the project area. These potential impacts on local and regional aquatic ecological values are discussed in more detail in the response to Question 4 below.	Responses to each of the IESC's detailed comments are provided below.

<table>
<tr><th>Comment</th><th>IESC Comment</th><th>Response</th></tr>
<tr><td>22</td><td>The proponent has predicted losses of baseflow to the Hunter River, Dart Brook and Sandy Creek at the annual scale (HEC 2020, p. 85); however, there has been no modelling to assess whether there will be an increase in low- or no-flow days and other ecologically important components of the flow regime. Consequently, it is difficult to verify the predicted impacts, especially on aquatic biota and riparian vegetation. Changes in flow regimes (e.g. flow duration, timing of onset of flow) in ephemeral creeks can have major repercussions for biodiversity and composition of their aquatic and riparian communities (Datry et al. 2017).</td><td rowspan="3">Changes in groundwater-derived baseflow have been predicted by AGE (2020) using a numerical groundwater model. The maximum predicted reduction in baseflow due to the Project is as follows:
• 32 ML/year (or approximately 0.09 ML/day) in the Hunter River;
• 6 ML/year (or approximately 0.02 ML/day) in Sandy Creek; and
• 13 ML/year (or approximately 0.04 ML/day) in Dart Brook.
These streams are managed in accordance with the following water sharing plans under the *Water Management Act 2000*:
• The Hunter River is managed in accordance with the *Water Sharing Plan for the Hunter Regulated River Water Source 2016.*
• Sandy Creek and Dart Brook are managed in accordance with the *Water Sharing Plan for the Hunter Unregulated and Alluvial Water Sources 2009.*
In accordance with the relevant water sharing plans, MACH would obtain and hold sufficient water access licences to account for the predicted take from each of these water sources. Relevant entitlements under these licences would be retired at the completion of the Project to account for groundwater take during the recovery of the groundwater system post-mining.
The Hunter River is a regulated river supplying water from Glenbawn Dam to a range of industrial and agricultural users as well as town water supplies. WaterNSW releases water from Glenbawn Dam based on water orders received from licensed downstream users and therefore no longer has a natural flow regime. The total predicted reduction from the Hunter River water source (51 ML/year, made up of the combined baseflow loss from the Hunter River, Sandy Creek and Dart Brook) amounts to approximately 0.018% of the 287,102 ML mean annual total flow in the Hunter River at Muswellbrook (GS 210002).
Clause 19 of the *Water Sharing Plan for the Hunter Unregulated and Alluvial Water Sources 2009* addresses the planned environmental water requirements for its water sources (including Sandy Creek and Dart Brook). Subclause 19(1) relevantly states (emphasis added):
19 Planned environmental water
(1) Planned environmental water is identified and established in these water sources as follows—
(a) water volume in excess of the respective long-term average annual extraction limit established in clause 44 of this Plan may not be taken and used for any purpose in these water sources, ***thereby protecting a proportion of river flows for fundamental ecosystem needs from increases in long-term water extraction****, and*
(b) for all water sources, ***the water remaining in the water source after the taking of water to meet basic landholder rights and for access licences*** *in accordance with the rules identified in subclause (3) and clause 68.*
As the predicted baseflow take would be accounted for under ‘access licences’ (i.e. already held by MACH or purchased from other current water users), it would not affect the volume of planned environmental water established for Sandy Creek and Dart Brook under the *Water Sharing Plan for the Hunter Unregulated and Alluvial Water Sources 2009.* The number of licences required in these water sources for the Project represent less than 1% of the total water access licences available in each source.</td></tr>
<tr><td>23</td><td>The proponent states that the hydrological impacts to the Hunter River, Dart Brook and Sandy Creek will be minimal. A maximum 63% loss of catchment area for Rosebrook Creek is likely to cause material habitat degradation; however, this is not an increase relative to the already approved mine and the proponent has committed to rehabilitating this catchment post-closure.</td></tr>
<tr><td>24</td><td>The potential cumulative impact of baseflow reduction on riverine biota (e.g. fish, invertebrates) has not been assessed at temporal scales appropriate to ecological processes such as migration (fish) or use of inundated streamside habitats. This is especially where the collective change in flow might exceed an ecological threshold (tipping point) such as preventing native fish passage during low flows or alienating aquatic benthic habitat along the river margins.</td></tr>
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Comment	IESC Comment	Response
25	Groundwater drawdown appears to have been adequately modelled. The proponent has predicted that ecological impacts from drawdown will be minimal (AGE 2020, p. 93). AGE (2020, p. 109) have also recommended that an additional shallow monitoring bore be constructed in the area of the Forest Red Gum Grassy Open Woodland, a potential Type 3 GDE. The depth of this bore is not detailed and it is assumed that this bore would be completed in the weathered overburden. The IESC recommends that a deeper monitoring bore also be drilled into the overburden to a depth just above the Warkworth seam to provide an early indicator of any depressurisation propagating towards the surface. Ideally, there would be similar nested bores at the northern, central and southern end of this woodland. Data from these bores could also be used to supplement assessments of groundwater use by vegetation depending on findings from the work suggested in Paragraph 37.	Consistent with the recommendation from the IESC, MACH would establish a nested groundwater monitoring site in the vicinity of the potential Type 3 GDE. The nested monitoring site would include: • A bore in the weathered overburden. • A bore in the overburden immediately above the Warkworth Seam. The installation and monitoring program for the bore would be documented in the Water Management Plan for the Project. This groundwater monitoring would be supported by vegetation monitoring, as described in the response to IESC Comment 37. The establishment of multiple nested sites is not considered warranted given the very limited variation in hydrogeology that would be expected to occur across the small area of woodland involved (i.e. less than 3 hectares).

<table>
<tr><th>Comment</th><th>IESC Comment</th><th>Response</th></tr>
<tr><td>26</td><td>The proponent has sampled for stygofauna over two days in November 2018, identifying three taxa and concluding that impacts to stygofauna will be insignificant as the identified taxa are widespread throughout the Hunter region and significant drawdown is not predicted (Bio-Analysis 2020, p. 66). However, the conclusion that the taxa are widespread is probably because they were only identified to family level; species-level identification is needed to confirm that the sampled stygofauna are not endemic species with a highly restricted range and potentially vulnerable to drawdown.</td><td rowspan="3">Stygofauna sampling undertaken for the Project in November 2018 was supplemented by data from stygofauna sampling at thirteen bores and wells in the vicinity of the Bengalla Mine (ELA, 2013).

In both programs, stygofauna were only collected from bores accessing the Hunter River alluvium (i.e. no stygofauna was collected or identified from bores that were sampled accessing the hard rock or other alluvial areas).

There is no significant drawdown predicted along the Hunter River alluvium and therefore potential impacts to these stygofauna populations are predicted to be negligible (AGE, 2020; Bio-analysis, 2020).

Project predicted baseflow reduction in other alluvial systems (i.e. Sandy Creek and Dartbrook) is minor as they are more distant elements of the broader Hunter River alluvial system. Sandy Creek is located some 4.3 km from the Project open cut and Dartbrook some 1.3 km.

Notwithstanding the above, MACH would undertake two additional rounds of seasonal stygofauna sampling as part of the development of the Water Management Plan for the Project.</td></tr>
<tr><td>27</td><td>Stygofaunal sampling of other Hunter River bores revealed that new taxa were still being collected after four sampling periods in over half the bores (Hancock and Boulton 2009). This indicates that a single set of samples is inadequate to reliably document taxa richness or seasonal variability in community composition.</td></tr>
<tr><td>28</td><td>As groundwater invertebrates facilitate many ecosystem services (Boulton et al. 2008, Hose and Stumpp 2019) that may be impaired by altered stygofaunal community composition, the IESC recommends further sampling by the proponent (including the alluvium of Sandy Creek where saturated sediments may persist when surface flow ceases). Collection of seasonal samples and annual monitoring of alluvial bores for stygofauna will enable the proponent to support their predictions that impacts of the project on stygofauna will be negligible. Mitigation measures, if any, should be described if drawdown is likely to impact stygofaunal communities or sever metapopulations.</td></tr>
<tr><td>29</td><td>The proponent has used appropriate sampling methods for stream habitat assessment and aquatic invertebrates, and conducted targeted surveys of threatened species that may occur in the area. It was concluded that no significant ecological impacts of the project on aquatic biota or threatened species are likely (Bio-Analysis 2020, Section 8.0). The IESC agrees with this assessment but recommends stream health monitoring should continue at sites within the project area and downstream, complemented by an appropriate management plan to mitigate any detected impacts of altered streamflows, water quality or aquatic habitat caused by the project.</td><td>Ongoing stream health monitoring is undertaken in accordance with the approved Mount Pleasant Operation Water Management Plan. This stream health monitoring would continue for the Project.</td></tr>
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Comment	IESC Comment	Response
30	The IESC considers that the project area and surrounding ecosystem could provide suitable habitat for the Green and Golden Bell Frog (Litoria aurea), Green-thighed Frog (Litoria brevipalmata) and Booroolong Frog (Litoria booroolongensis), particularly after substantial rainfall. Surveys undertaken after such events will be useful because they will increase the understanding of the environmental values of this area under a changing climatic regime.	Vegetation communities (Plant Community Types) mapped in the Project area were identified as potential habitat for the Green and Golden Bell Frog (*Litoria aurea*) and Green-thighed Frog (*Litoria brevipalmata*) elsewhere in NSW. The vegetation communities in the Project area are not associated with Booroolong Frog (*Litoria booroolongensis*). Future Ecology (2020) inspected the occurrences of these vegetation communities and searched for potential habitat such as vegetated pools, flooded areas and dams with bullrushes (*Typha sp.*) and/or spikerushes (*Eleocharis sp.*). Future Ecology (2020) concluded that there was no potential habitat for these frogs within the Project area. The closest record of the Green and Golden Bell Frog is approximately 22 km south-east of the Project at Lake Liddell. The closest record of the Green-thighed Frog is approximately 90 km south-east of the Project (Future Ecology, 2020). The closest record of the Booroolong Frog (*Litoria booroolongensis*) is approximately 40 km east of the Project and was identified in 1979. No additional surveys are warranted for this frog species.
31	The EIS is generally lacking in detailed avoidance, mitigation and minimisation strategies which are outlined in greater depth in the proponent's Water and Biodiversity Management plans, dated from 2017 and 2018 respectively. The IESC notes that these documents do not sufficiently reflect the most recent research conducted by the proponent presented in the EIS, including: a. surface water and groundwater reports (HEC 2020; AGE 2020); b. the latest vegetation mapping (Hunter Eco 2021, Appendix E); and, c. stygofauna surveys (Bio-Analysis 2020).	The existing Water Management Plan and Biodiversity Management Plan would be reviewed and revised to incorporate the Project, subject to the conditions of any Development Consent for the Project. The updated Water Management Plan and Biodiversity Management Plan would incorporate the findings of the EIS documents identified in the IESC's comment.

Comment	IESC Comment	Response
32	In particular, no strategies to minimise or avoid impacts to Sandy Creek have been presented as the proponent considers that impacts to this system will be negligible (Bio-Analysis 2020, pp. 65-66). The additional recommended work (Paragraph 37) may indicate that some impacts are possible (especially to GDEs from drawdown and to aquatic biota from altered flow regimes), necessitating the presentation of appropriate mitigation and monitoring strategies.	Sandy Creek is located some 4.3 km from the Project open cut. As above, the existing Water Management Plan and Biodiversity Management Plan would be reviewed and revised to incorporate the Project subject to the conditions of any Development Consent for the Project. The existing Water Management Plan includes: • trigger levels and trigger action response plans for potential impacts on flow, water level/pressure, water quality and stream health; • processes to deal with a groundwater and surface water-related complaints; • an impact investigation protocol; and • a response plan, in the event that an investigation conclusively attributes an adverse impact to the Mount Pleasant Operation. Appropriate trigger levels, trigger action response plans, impact investigation protocols and response plans would be developed as part of the updated Water Management Plan for the Project. This would include trigger levels to confirm that impacts are consistent with the predictions in the EIS (e.g. trigger levels would be established for the potential Type 3 GDE and Sandy Creek to confirm that impacts remain negligible).
33	If vegetation (especially of CEECs) in the relinquished area is found to be groundwater-dependent (Paragraph 37) and if drawdown occurs in this area that may exceed root depths of these Type 3 GDEs, strategies to avoid this drawdown need to be presented because it is unlikely that mitigation is feasible. Failing to do this and avoid excessive drawdown may compromise the benefits and biodiversity values of the remnant native vegetation in the relinquished area.	Consistent with the approach outlined in the response to IESC Comment 32, MACH would develop appropriate trigger levels, trigger action response plans, impact investigation protocols and response plans for the potential Type 3 GDE (i.e. approximately 3 ha of Forest Red Gum Grassy Open Forest). In the unlikely event that an investigation conclusively attributes an adverse impact to the Type 3 GDE to the Project, MACH would offset the impact in accordance with the NSW *Biodiversity Conservation Act 2016*.
34	The proponent has detailed three appropriate protocols for assessing changes in groundwater level, groundwater quality and privately owned bores (AGE 2020, Tables 10.3-5, pp. 113-114). Outside of these protocols, there are recommendations to increase the number of groundwater monitoring locations (AGE 2020, p. 109) and a continued commitment to the current Water Management Plan (AGE 2020, p. 107), both of which are supported by the IESC.	Noted.

Comment	IESC Comment	Response
35	An increase in the suite of analytes in groundwaters, primarily metals, being tested is also recommended (AGE 2020, Table 10.2) and the IESC supports this recommendation. The Groundwater Management Plan suggests that groundwater quality monitoring data should be assessed against the ANZECC/ARMCANZ (2000) recreational water quality guidelines. However, the IESC recommends that these data be assessed against either guidelines for aquatic ecosystem protection (in the absence of groundwater guidelines for contaminants) or, as previously, using guidelines for irrigation, livestock or drinking water if these are the intended beneficial uses.	The *Australian and New Zealand Guidelines for Fresh and Marine Water Quality* (ANZECC & ARMCANZ, 2000) recommends that wherever possible site-specific data be used to define trigger values for physical and chemical factors which can adversely impact the environment. Until sufficient data is available to develop site-specific triggers, interim trigger levels would be applied in accordance with the following ANZECC & ARMCANZ (2000) guideline values based on the relevant beneficial use (e.g. ecosystem protection guideline values would be applied for potential GDEs, livestock guideline values would be applied for stock bores and drinking water guideline values would be applied for domestic bores).
36	If chemical dust suppressants are to be used during low rainfall periods (HEC 2020, p. 75), additional information is needed on which chemical suppressants may be used, how they will be applied, and their potential impacts on nearby waters.	The use of chemical dust suppressants during low rainfall periods would be described in the Air Quality Management Plan and Water Management Plan to be developed for the Project.
37	The proponent has committed to monitoring the health of the Forest Red Gum Grassy Open Woodland GDE. The IESC recommends that the proponent use direct techniques (e.g. stable isotopes, leaf water potential and soil water potential) suggested by Doody et al. (2019) and Jones et al. (2020) to assess groundwater use by this community as well as vegetation in the relinquished area (especially CEECs and riparian vegetation) and vegetation along Sandy Creek. With this information, the proponent will be able to state more confidently if these communities are GDEs, whether mitigation is required, and how impacts (both incremental and cumulative) on this vegetation from groundwater drawdown can be managed.	Potential impacts on Sandy Creek and the potential Type 3 GDE are predicted to be negligible (HEC, 2020; AGE, 2020; Bio-Analysis, 2020). It is noted that Sandy Creek is located some 4.3 km from the Project open cut. Notwithstanding, monitoring of vegetation along Sandy Creek would continue to be undertaken in accordance with the stream health monitoring program described in the approved Water Management Plan. Proposed groundwater monitoring in the vicinity of the potential Type 3 GDE is described in the response to IESC Comment 25. This groundwater monitoring would be supplemented with periodic vegetation monitoring, which would be described in the Biodiversity Management Plan to be developed for the Project.
38	The IESC further recommends that dedicated vegetation surveys and mapping be extended west of the project area, particularly surrounding Sandy Creek, and where groundwater drawdown is predicted. Where appropriate, groundwater-dependence of this vegetation should be assessed so that predictions of potential impacts can be refined and suitable mitigation plans can be developed.	

Comment	IESC Comment	Response
39	The IESC recommends that additional stygofauna sampling be undertaken that accounts for seasonal and rainfall variation, that all collected specimens be identified as far as practical (to ensure that endemic species are not being overlooked because of coarse taxonomic assessment) and that potential impacts of drawdown and altered groundwater quality on their ecological value and ecosystem services be considered (see Paragraphs 26 and 28). These surveys should be extended to the Sandy Creek alluvium (see Paragraph 28).	As described in the response to IESC Comments 26 to 28, there is no significant drawdown predicted along the Hunter River alluvium and therefore potential impacts to these stygofauna populations are predicted to be negligible (AGE, 2020; Bio-analysis, 2020). Notwithstanding the above, MACH would undertake two additional rounds of seasonal stygofauna sampling as part of the development of the Water Management Plan for the Project.
40	Additional monitoring of aquatic biota should be conducted following substantial or extended rainfall. These measures will provide an important means of assessing climate change impacts and will contribute to a better understanding of potential cumulative impacts.	As described above, monitoring of vegetation along Sandy Creek would continue to be undertaken in accordance with the stream health monitoring program described in the approved Water Management Plan.

References

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