BARALABA SOUTH

Baralaba South Project
Environmental Impact Statement

ATTACHMENT 8

Peer Review
Flood Modelling and Assessment

arc ENVIRONMENTAL SOLUTIONS

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MEMORANDUM

Date	1 December 2023
Attention	Graeme Sherlock
Company	Baralaba Coal Company Pty Ltd
WRM ref.	0876-17-E
Subject	Independent Peer Review of the Baralaba South Project Flood Impact Assessment

Dear Graeme,

1 INTRODUCTION

The purpose of this peer review is to determine the suitability of the flood modelling, mapping and impact assessment undertaken by Engeny (2023) for the Baralaba South Project. The key questions explored as part of the review are:

1. Has all available data been used to in the assessment?
2. Has the hydrology model been conceptualised correctly and calibrated adequately?
3. Is the methodology used to define the adopted design discharges in accordance with best practice?
4. Has the hydraulic model been set up with parameters that are in the normal range?
5. Are the model runs and results fit for the purpose of assessing the flood risk and flood impact of the Baralaba South Project.

These questions have been answered from a review of the report entitled “Baralaba South Pty Ltd, Baralaba South Project, Flood Impact assessment” by Engeny dated 24 November 2023. Engeny developed an URBS rainfall runoff routing model of the Dawson River (including Banana Creek) catchment to estimate design discharges and a TUFLOW two dimensional hydraulic model to determine design flood levels and flood impacts.

The review has been separated into the following components:

- Hydrological modelling review,
- Hydraulic modelling review; and
- Flood impact review.

2 HYDROLOGICAL MODELLING REVIEW

2.1 MODEL DEVELOPMENT AND CALIBRATION

Engeny developed an URBS rainfall runoff routing model of the Dawson River (including Banana Creek) to estimate design discharges. In general, the model would appear to provide a good representation of catchment runoff behaviour to estimate design discharges.

The following is of note:

- The model has been delineated with a total of 244 subcatchments modelled using the URBS split mode. Catchment area and slope have been used for subcatchment routing and channel length and slope for channel routing. The modelling methodology is appropriate although potentially more complex than required given the available data.
- The model was calibrated to the recorded flow data for five historical events using available daily and sub-daily rainfall. It would appear that a thorough search of available rainfall has been undertaken and used for the analysis. There is a reasonable spread of available daily rainfall stations throughout the catchment but limited sub-daily rainfall stations, particularly for the earlier historical events. There is also a lack of recorded rainfall data in the lower Dawson River catchment including Banana Creek and Mimosa Creek, which would hinder model calibration in these areas. Note that this is a comment on the available data, not the appropriateness of the use of the data.
- The methodology used to convert the daily rainfalls to subdaily rainfalls is appropriate.
- The model has been calibrated to flood events generated both from the upper catchment and lower catchment, which is appropriate. Noting the lack of rainfall stations in the lower catchment, a reasonable calibration has been achieved for most gauging stations with the primary focus for model calibration being the Dawson Rivers at Beckers Gauge, which is the closest to the project site.
- The calibrated subcatchment storage lag (beta) is within the normal range. The channel storage lag (alpha) is very low and outside the normal range, likely due to use of the channel slope parameter. Notwithstanding, the channel routing would appear to be well represented by the adopted alpha and channel slope.

2.2 DESIGN HYDROLOGY

The design flood hydrology was derived using the design flood estimation methods described in the 2019 revision of Australian Rainfall and Runoff (ARR 19). The Dawson River design discharges have been validated against design discharges estimated from an annual series flood frequency analysis (FFA) of the recorded flows at the Beckers Gauge.

The following is of note:

- The FFA has been undertaken using data obtained from both the Beckers Gauge and the Baralaba Gauge, which was in operation before the construction of Neville Hewitt weir. This provides 96 years of historical data for the analysis, which is excellent.
- The RMC Bestfit software has been used to undertake the FFA, which differs from the FLIKE software recommended in ARR for FFA estimation. RMC Bestfit produces the most likely estimate for parameters (posterior mode) and the posterior predictive distribution. The latter distribution has been adopted by Engeny, which is consistent with the Expected AEP quantiles estimated by FLIKE. The Expected AEP quantile (Posterior Predictive) distribution will likely

produce relatively conservative estimates of peak discharges taking into consideration the uncertainty.

- The adopted 1% AEP discharge derived by URBS and the FFA are consistent. However, the adopted 10% AEP URBS discharge is some 10% lower than the FFA estimate. It is also lower than the Expected (posterior mode) value, which suggests that the URBS value is moderately low. The likely under estimation of the 10% AEP has no consequential impacts on the assessment given that the mine is not impacted by the 10% AEP event and only marginally impacted by the 1% AEP event.
- An alternative approach has been adopted to estimate design discharges for Banana Creek. Due to the lack of available calibration data for the catchment, regional parameters have been used derive design discharges. The adopted discharges are consistent with those estimated by the regional methods and would appear to be significantly higher than the design discharges that would be adopted had the Dawson River calibration parameters been used. Given the potential for the project to impact Banana Creek flows, the use of the more conservative (higher) discharges is appropriate.

3 HYDRAULIC MODELLING REVIEW

3.1 HYDRAULIC MODEL DEVELOPMENT AND CALIBRATION

The TUFLOW hydrodynamic model has been used to determine design flood levels and flood velocities across the Dawson River and Banana Creek floodplains and assess the flooding impacts of the project. TUFLOW has been used for similar applications throughout Australia and is considered suitable for undertaking the current assessment.

The following is of note:

- Topographical data was derived from multiple datasets generally using 1m digital elevation models, which has an appropriate level of vertical accuracy for the assessment. Locations on the edge of the model using Shuttle Radar Topography Model (SRTM) data should not impact on the model results. However, the flood depth levels presented in the figures in the SRTM areas should be used with caution.
- The modifications made to the topography to represent levees and the channel bathymetry appear reasonable and sufficient to represent ground conditions at the site.
- Model roughness values are generally consistent with expected values.
- The downstream boundary would appear to be sufficiently downstream to have no impact on design flood levels at the project site. The potential impacts on flood levels where the Don River flood peaks at the together with the Dawson River have been appropriately assessed.
- Model calibration of the 2010 event is reasonable with peak flood levels generally over predicted by about 0.37 m. Model is well calibrated to the 2013 event, which was smaller and more confined to the river channel and adjacent benches. This suggests that the roughness value adopted for ‘open space’ may be marginally high. The impact of using the high roughness value is not consequential for the assessment as it will produce conservatively high peak flood levels.
- Overall, it would appear that the model is fit for the purpose of estimate design flood levels adjacent to the project site and assessing flood impacts.

Design event mapping has been undertaken for a Dawson River based flood and separately for a Banana Creek based flood occurring concurrently with a 10% AEP Dawson River flood. Based on the historical flooding presented in the report, this assumption is reasonable, noting that the adoption of concurrent Dawson River and Banana Creek flood events would produce a flood event at Baralaba much larger than the design AEP of the incoming flood from each source.

3.2 FLOOD IMPACT ASSESSMENT

The TUFLOW model has been used to assess the impact of the Project on flood levels and flood velocities. The impact assessment has been undertaken appropriately. Noting that the adopted 1% AEP design flood levels may be conservative, the impacts of the project may also be conservative.

4 SUMMARY OF FINDINGS

In response to the key questions explored as part of the review

1. It appears that all available data been used to in the assessment
2. The hydrology model been conceptualised correctly and calibrated adequately
3. The methodology used to define the adopted design discharges is in accordance with best practice
4. The hydraulic model been set up with parameters that are in the normal range
5. The model runs and results are fit for the purpose of assessing the flood risk and flood impact of the Baralaba South Project.

Regards,

Greg Roads
Senior Principal Engineer