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# Memo

| To | Rupert Duckworth | Company | Strategen-JBS&G |
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| From | Brieland Jones | Job No. | 171N |
| Date | 24/06/2022 | Doc No. | 274c |
| Subject | Mulga Downs Rail Alignments (8B and 1B) – Surface Water Impact Assessment | | |

## 1. BACKGROUND

### 1.1 Mulga Downs Hub and Rail

Roy Hill Infrastructure Ltd (RHIL) is proposing to develop the Mulga Downs Hub and Rail Spur (hub and rail) located approximately 210 kilometres (km) south of Port Hedland and 180 km northwest of Newman in the Pilbara Region of Western Australia.

The hub and rail are being developed to provide a transport link to the existing Roy Hill rail line and port facilities for the associated Mulga Downs Iron Ore Mine. The mine includes a series of below ground open pits, waste rock dumps, a tailings storage facility, processing and other operational mine infrastructure. It will have an annualised rate of up to 25 Mtpa and production is scheduled to start in 2025. The two projects are being developed so that they are capable of operating independently of each other, but together they comprise the Mulga Downs Iron Ore Project.

### 1.2 This Assessment

The purpose of this assessment is to provide a concise technical assessment of the potential impacts of the Mulga Downs rail alignment on the hydrological (surface water) environment. A detailed assessment of the hydrology along the 8B and 1B rail alignments has been completed by Calibre. The findings of this work are presented in the reports:

> *Calibre 2022a. Rail Hydraulics and Hydrology FID Design Report. Revision 0 issued to Roy Hill 24 August 2022. Consultant Document Number COPP20176-REP-G-503.*
>
> *Calibre 2022b. Engineering and Technical Reports (Hydrology Report) – Rail Option 1B. Revision 0 issued to Roy Hill 24 August 2022. Consultant Document Number COPP20176-REP-G-601.*

The Calibre reports cited above should be read in conjunction with this assessment, as the relevant contents of the Calibre report have generally not been repeated.

The work completed by Calibre has not been technically reviewed as part of the following assessment, however, results and mapping have been used to provide a subjective assessment of the impacts of the rail on the surface water environment. The following assessment identifies potential environmental impacts due to the construction of linear infrastructure (i.e. railway) and the risks these propose to the

environment, taking into account the proposed surface water management infrastructure and the environmental receptors adjacent to the rail alignments.

RHIL is currently completing further investigations and stakeholder consultation to inform the selection of the preferred alignment and associated engineering design. Only one alignment will be constructed.

## 2. HYDROLOGY OVERVIEW

### 2.1 Railway Alignment 8B

Baseline hydrological data, including an assessment of the catchments that would be intercepted by the 8B rail alignment were defined by Calibre (2022a) using Landgate data. The figure taken from their report showing the defined catchments is shown below (Figure 1).

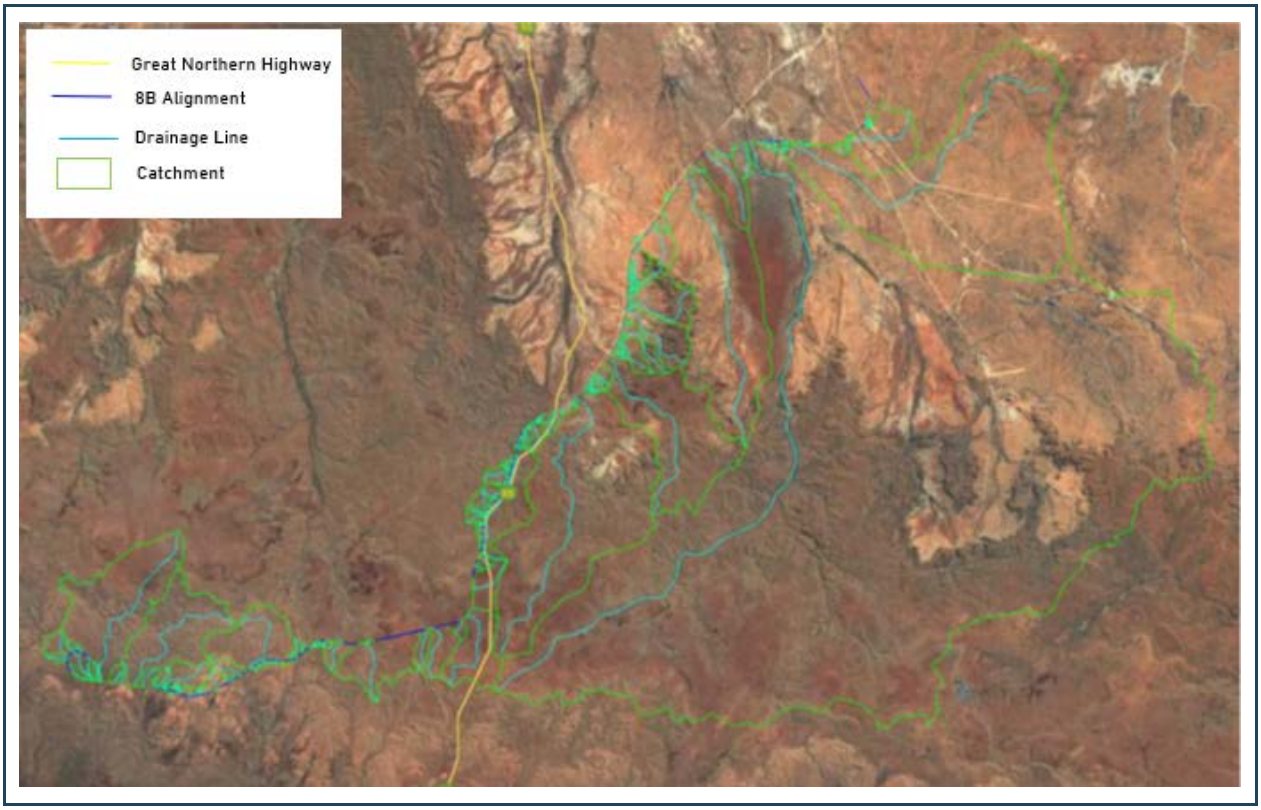


Figure 1 8B Rail Alignment Intercepted Catchments (from Calibre 2022a)

The largest catchment area intercepted by the railway is the Coonarie Creek catchment, with an area of approximately 17,835 hectares (178km$^2$). Peak flows for the smaller catchments were estimated by Calibre using the Flavell regional flood frequency procedures (RFFP) method. For Coonarie Creek, an XP RAFTS model was used to estimate peak design flow rates, and a 2D TUFLOW hydraulic model developed to map the flooding before and after the construction of the proposed bridge creek crossing.

The Calibre report outlines the design of the rail alignment and stated that culverts have been placed "*in the most defined streams, wherever cover requirements allowed, ensuring that natural stream flows were unimpeded and existing waterways were kept as natural as possible. In some instances, stream training will be required following culvert installation to reinstate stable drainage channels once construction is complete. There are a total of 142 culvert locations*".

The term 'stream training' is assumed to refer to using civil construction methods to re-establish an existing drainage line either side of an installed culvert to reinstate stable drainage channels.

## 2.2 Railway Alignment 1B

Calibre completed a similar-level assessment of the 1B rail alignment (Calibre 2022b); Figure 2 shows the catchments reporting to the alignment (taken from the Calibre report).

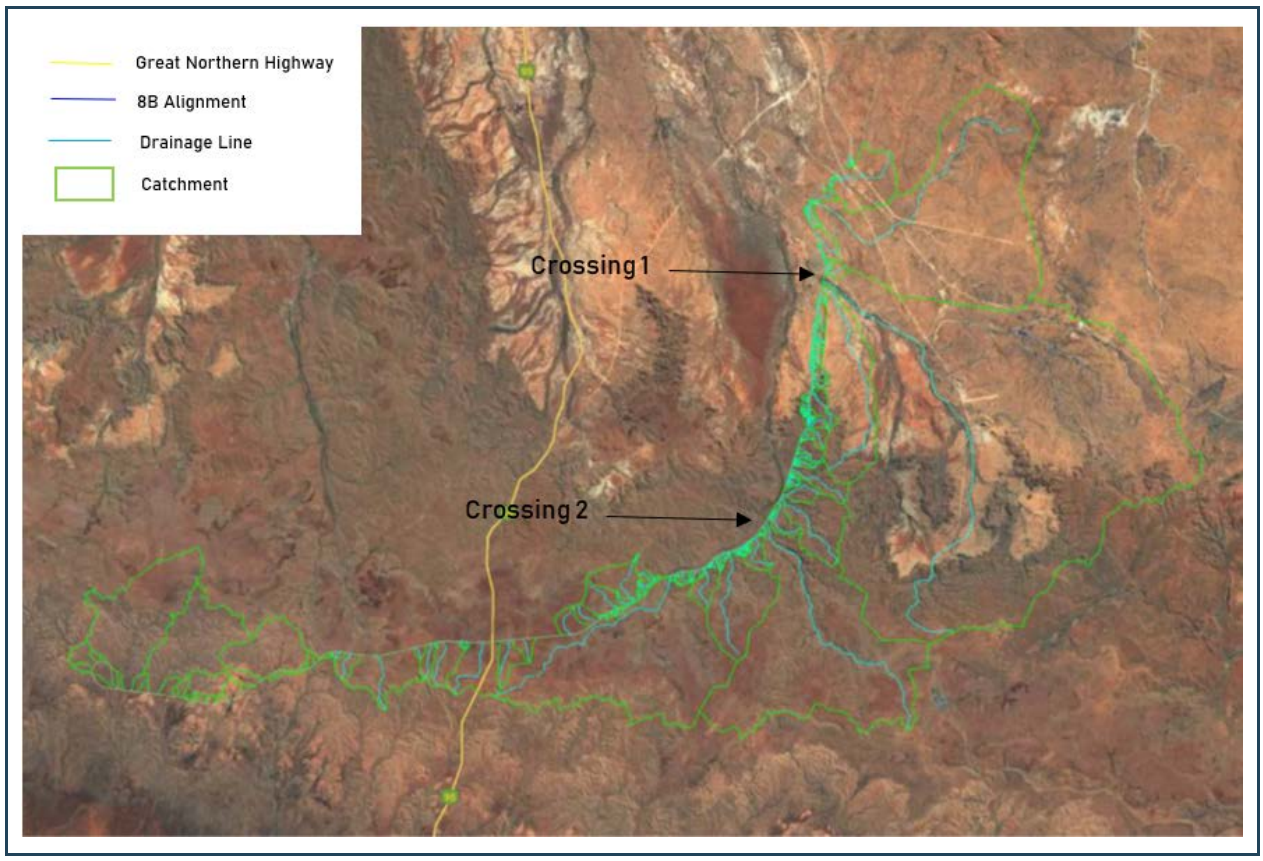


Figure 2 1B Rail Alignment Intercepted Catchments (from Calibre 2022b)

Similar to the 8B alignment assessment, the same design approach with respect to placement of culverts and hydraulic analysis at major river crossings has been completed. The general characteristics of the hydrology of the alignments will be similar, with the main crossing of Coonarie Creek for Option 1B approximately 23 km further upstream (Crossing 1 in Figure 2) than Option 8B.

The 1B rail alignment also follows the floodplain of one of the main Coonarie Creek tributaries. After crossing to the eastern side of Coonarie Creek tributary at Crossing 2 (refer Figure 2), the proposed alignment of 1B is located within the tributary valley and in proximity (i.e. within 2km) to the tributary low flow channel.

The following issues will need to be considered with this section of the alignment:

- Any impact of the embankment constricting the area of flow across the Coonarie Creek floodplain, which could alter the flood levels in the creek.
- The potential erosive impact of the creek on the rail embankment.

- Where the alignment crosses relatively large tributaries to the Coonarie Creek main tributary, the rail alignment needs to cross broad floodplains in close proximity to their junction with the Creek. The flood management designs in this area will need to consider the flow through the tributary plus the potential backwater flood levels from Coonarie Creek. There are two major crossings required for the 1B alignment as follows:
    - Crossing 1 – A 420m wide crossing of Coonarie Creek located 5km south of the convergence of the 1B and 8B alignments (refer Figure 3).
    - Crossing 2 – A 500m wide crossing of a tributary to the main Coonarie Creek tributary (refer Figure 4).

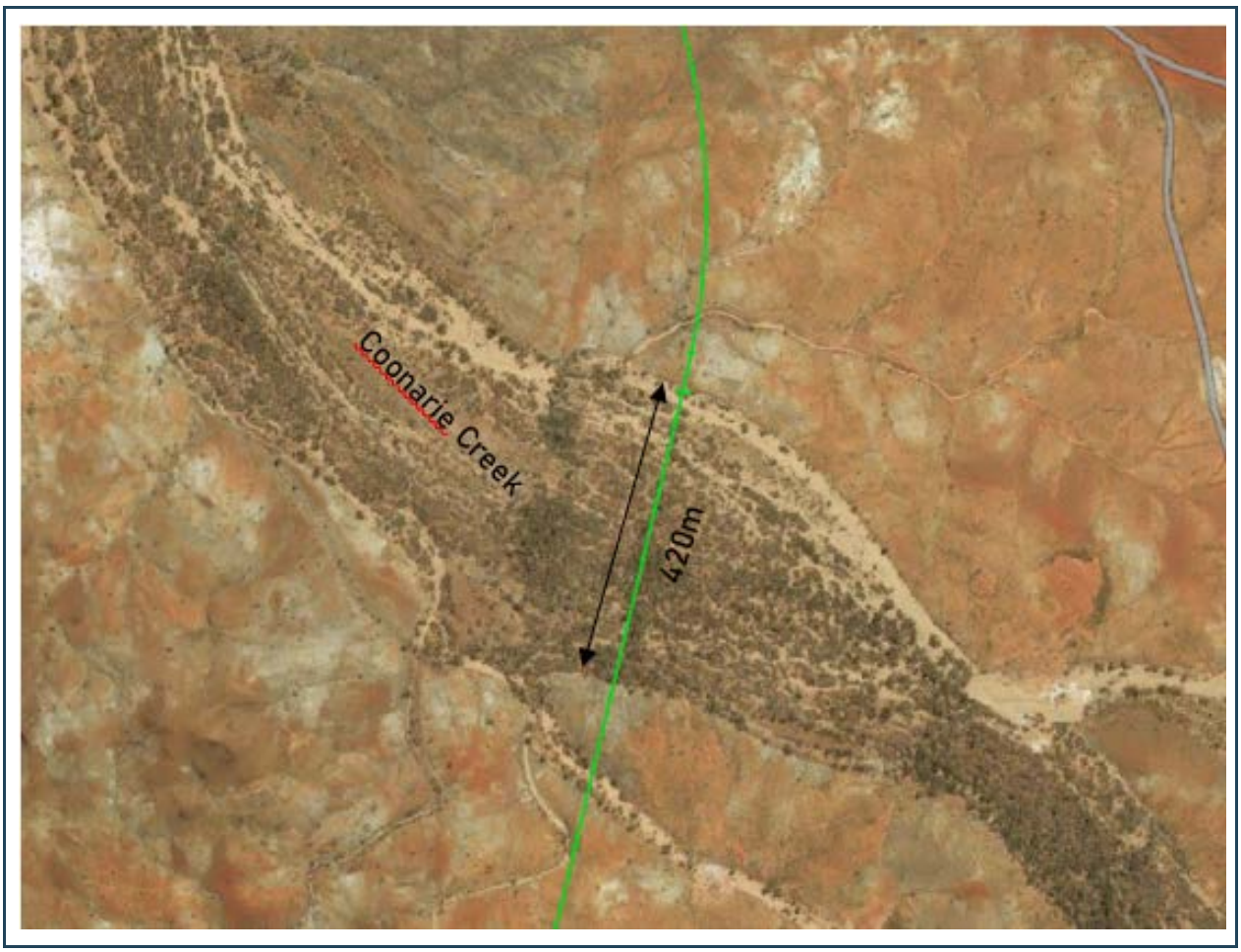


Figure 3 Crossing 1 – 1B Rail Alignment Crossing Coonarie Creek

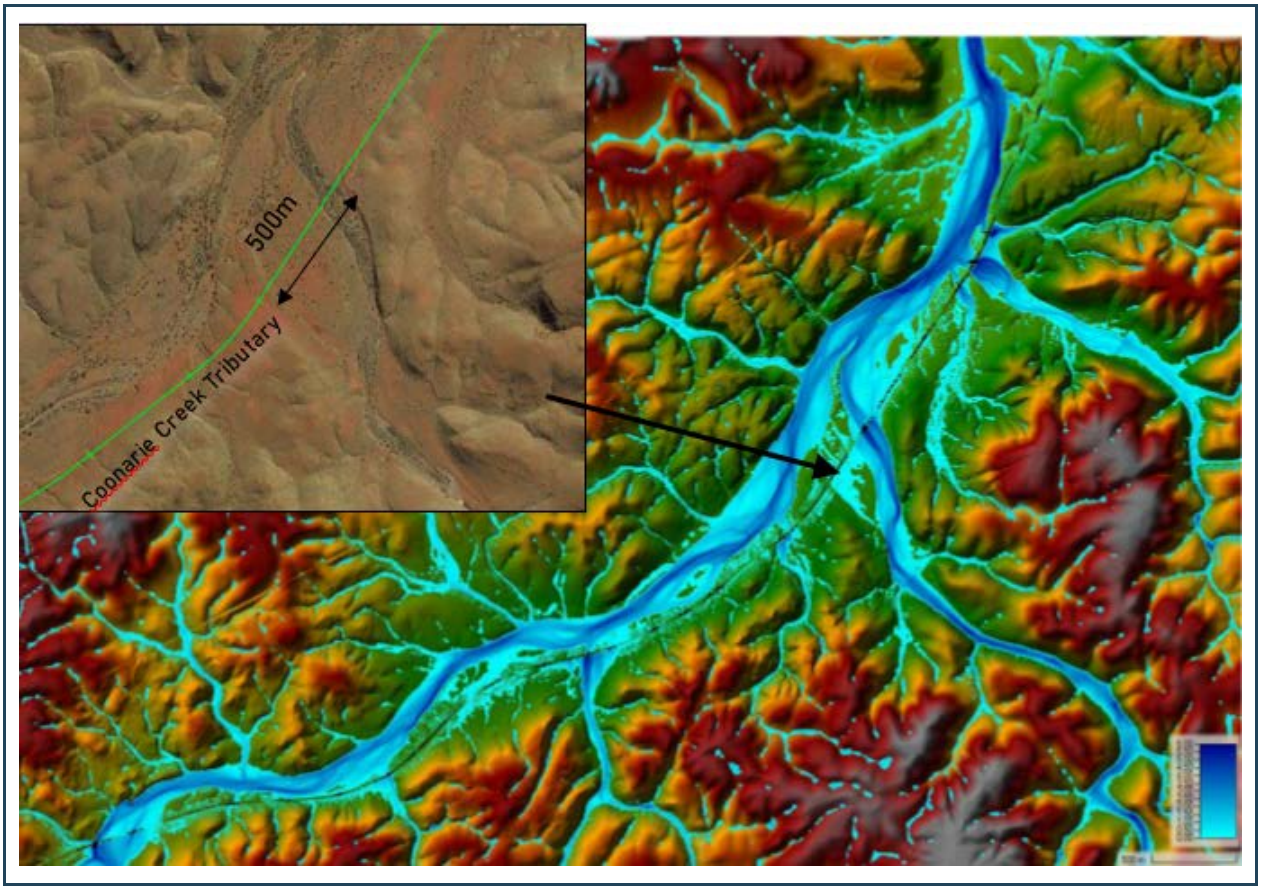


Figure 4 Crossing 2 – Alignment 1B in parallel to main Coonarie Creek Tributary (flood map from Calibre 2022b)

## 3. POTENTIAL IMPACTS

The considered rail alignments 8B and 1B have the potential to interrupt the flow regime via the following processes:

1. Ponding on the upstream side of the rail, exposing vegetation to waterlogging stress.
2. Runoff "shadowing" on the downstream side of the alignment, which could impact vegetation which is reliant on local sheet flow runoff (i.e. increased drought stress).
3. Concentration of flows at culverts, which could increase flow velocities and therefore result in erosion and sedimentation of the water ways.

The proposed 8B rail alignment runs in parallel with other linear infrastructure (FMG rail and Great Northern Highway) for approximately 15 km of its alignment, such that it will be installed across drainage lines that are already impacted by linear infrastructure. In particular, the alignment crosses Bea Bea Creek in proximity to the location that both FMG Rail and Great Northern Highway cross the creek and in proximity to the Bea Bea Creek Quarry development.

The proposed 1B alignment runs in parallel with a tributary to Coonarie Creek (i.e. within 200m) for approximately 7km. As the rail alignment will intercept runoff from the tributary catchment, there is potential that ponding could occur along this stretch of the proposed rail.

The design criteria applied to sizing the culverts and waterway crossings where it is aligned parallel to other rail and road infrastructure will be equal to, or greater than, the sizing used at the existing rail alignment, to ensure there is no impact to the other infrastructure alignment.

When the design of the surface water management along the rail is accounted for, both rail alignments (8B and 1B) are considered low risk to the environment for the following reasons:

- Installation of culverts at defined drainage lines will mean that there will be no net reduction in water flow volumes to the downstream environment (i.e. flow interrupted by the rail alignment is allowed to pass downstream). Where required, drainage parallel to the rail (i.e. diversion drains) will be constructed to ensure runoff collected against the embankment drains to the nearest culvert. By facilitating through-flow, water impoundment and ponding will be minimal.
- Reductions in surface water flow will be limited to runoff shadowing on the downstream side of the rail alignment where sheet flow behaviour occurs.
- Erosion protection around the culverts will be designed to reduce the likelihood of erosion to the drainage lines. As stated above from the Calibre report "In some instances, stream training will be required following culvert installation to reinstate stable drainage channels once construction is complete."
- Pre-development and post-development flood mapping for the Coonarie Creek bridge crossings has been completed by Calibre, which has identified potential changes to the flow depths and velocities during the 2% AEP flood event (refer to drawings at end of Calibre reports).

Note that flora surveys along the 8B rail alignment (Strategen 2022) have indicated that the vegetation communities along the rail alignment are not reliant on sheetflow runoff to meet their ecological requirements. As such, the impact of runoff shadowing on vegetation will be minimal. This has been assumed for the 1B alignment as well.

## 4. SUMMARY

The proposed Mulga Downs railway alignments (8B and 1B), which connect to the existing Roy Hill railway, have the potential to impact on the existing surface water hydrological regime. The potential impacts include increased ponding (upgradient), water shadowing (down gradient) and concentration of flows resulting in erosion.

Calibre has completed hydrology and hydraulic assessments of the rail alignment Options 8B and 1B which have identified the requirement for placement and sizing of culverts and waterway crossings and discussed proposed surface water management measures. The design of the proposed surface water management measures (including culverts/bridge, stream training, grading of ground along the alignment to the culverts and erosion protection measures) will minimise disruption to the surface water regime and reduces the potential impact of the rail alignment on environmental receptors (native vegetation) to an acceptable level.

A flora survey has found that vegetation along the 8B rail alignment has a low dependency on localised sheet flow runoff, such that any localised water shadowing due to the rail alignment blocking sheet flow runoff should not impact vegetation. This is assumed to be the case for the 1B alignment.

## 5. REFERENCES

Calibre (2022a). Rail Hydraulics and Hydrology FID Design Report. Unpublished report prepared by Calibre for Roy Hill. Consultant document number: COPP20176-REP-G-503, Revision 0, 24 August 2022.

Calibre (2022b). Engineering and Technical Reports (Hydrology Report) – Rail Option 1B. Unpublished report prepared by Calibre for Roy Hill. Consultant Document Number COPP20176-REP-G-602, Revision 0, 24 August 2022.

Strategen (2022). Baseline flora and vegetation survey for the Mulga Downs Hub and Rail Spur proposed rail corridors. Unpublished report prepared by Strategen-JBS&G for Hancock Prospecting Pty Ltd.

We trust that this memo meets your current requirements. Please contact us if you require any additional information.

Regards,

*Mark* *Brieland*

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