

To: Duncan Gray, Environment Canterbury
Martina Armstrong, LandPro

CC:

From: Richard Allibone, Water Ways Consulting Ltd

Date: 22 February 2017

Subject: Bush Gully Stream Ecological Assessment

Dear Duncan,

This memo has been written in reply to the S92 request from Environment Canterbury for an assessment of the effect of the North ELF development on the ecology of Bush Gully Stream downstream of the North ELF facility.

Bush Gully Stream

Bush Gully Stream was first sampled in the vicinity of the North ELF site by Golder Associates in November 2013 Golder (2014¹). This survey noted the stream was a series of poorly connected pools with no fencing allowing stock (cattle) access to the stream (Figure 1). The resulting stream habitat was heavily modified by the stock activity. Since the Golder Associates survey the survey area has been further modified by channel straightening and drainage works. This assessment of effects is based on the initial site conditions observed by Golder Associates rather than the current site conditions.



Figure 1: Bush Gully Stream in the vicinity of CC24, November 2013.

¹ Golder Associates (2014) Canterbury Coal (2013) Ltd: Aquatic baseline assessment of values of streams in the Wainiwaniwa Valley. Client report prepared for Bathurst Resources Ltd.

Bush Gully Stream has two major tributaries in its upper catchment – Bush Gully Stream, the larger of the two tributaries on the true left of the valley, that is unaffected by the North ELF facility. The smaller Bush Gully Stream tributary on the true right of the valley has the North ELF facility on one of its tributaries.

A farm track crosses the smaller branch of Bush Gully Stream approximately 10 m upstream of the confluence of the branches. The track culvert was assessed in July 2016 (Water Ways Consulting 2016²) as a fish passage barrier and Golder (2014) and Water Ways Consulting (2016) found no fish upstream of this culvert. Therefore, for the purposes of this assessment the effects on fish are assessed from the farm track culvert downstream. Golder (2014) found Canterbury mudfish, and upland bully present in this reach of Bush Gully Stream. These two species and occasional Canterbury galaxias were found approximately 500 m further downstream.

Water quality measurements found the stream had low dissolved oxygen levels in the upper reach. pH rose from 7.4 to 7.1 and conductivity declined from 349 $\mu\text{m}/\text{cm}$ to 267 $\mu\text{m}/\text{cm}$ in a downstream direction. MCI and QMCI scores indicated poor water and habitat quality.

Assessment of Effects.

The North ELF facility will discharge mine influenced water to Bush Gully Stream. The discharge water will be treated to manage turbidity, acidity and heavy metals and no untreated water will be released from the North ELF. A discharge compliance point CC24 has been proposed that is approximately 10 m downstream of the confluence of the two major branches of upper Bush Gully Stream. Discharges at the compliance point will undergo significant dilution when the two Bush Gully Stream branches join 10 m upstream of the compliance point. With respect to the fish fauna the compliance point is approximately 20 m downstream from the maximum upstream extent of fish in Bush Gully Stream. Therefore, by far the majority of the fish population will be subject to the water conditions at the compliance point. The compliance point is expected to meet the LWRP 95% and 99% compliance criteria for pH and heavy metals, except boron for a *hill-fed lower* classified stream.

Canterbury mudfish tolerance of heavy metals (Mn, Ni, Zn, Cu, Fe and Al) has not been assessed. O'Brien & Dunn (2007³) reviewed the mudfish literature and found no studies that have assessed the tolerance of mudfish (of any species) to heavy metals. However, Bathurst Resource Ltd⁴ (2017) have provided some water quality information for discharges from historic coal mines in Bush Gully and the lower reaches of Bush Gully Stream. Bathurst Resources Ltd (2017) Table 15 provides heavy metal levels in Bush Gully Stream at site CC08 conf. The sample data available is limited and shows metal concentrations vary. The boron, zinc and aluminium concentration can exceed the 95% and 99% water quality standards for a *hill-fed lower* stream. Site CC08 conf in lower Bush Gully is within a section of Bush Gully Stream sampled by Harding & McIntosh⁵ (2006) and Harding et al⁶ (2007) and Canterbury galaxias have been found near CC08 conf and Canterbury mudfish and upland bully were common at two sites further downstream. As the same three fish species are present in the upper

² WaterWays Consulting (2016). Canterbury Coal: ELF project Bush Gully Assessment. Client Report prepared for Canterbury Coal Limited.

³ O'Brien L. K., Dunn, N. R. (2007). Mudfish (*Neochanna Galaxiidae*) literature review. Science for Conservation 277. Department of Conservation, Wellington NZ.

⁴ Bathurst Resources Limited (2017). Canterbury Coal Mine North ELF water management plan

⁵ Harding, J. S., & McIntosh, A. R. (2006). *The occurrence of Canterbury mudfish in Selwyn Plantation Board Ltd estate in the Waianiwi Valley*. Freshwater Ecology Research Group Research Report.

⁶ Harding, J. S., Kirk, L., Sinton, A., Wood, H., & Norton, D. (2007). *Canterbury mudfish (Neochanna burrowsius) populations in the upper Waianiwi Valley*. Freshwater Ecology Research Group Research Report

reaches of Bush Gully Stream this indicates they are tolerant of the current heavy metal loads that can exceed the *hill fed – lower* compliance limits. Therefore, as the North ELF discharge is to be treated to reduce heavy metal concentrations to comply with the *hill fed – lower* limits it is expected that fish will not be impacted by the discharge.

Turbidity treatment will be conducted via two settlement ponds and the use of flocculants. It is predicted that in low rainfall events the discharge will have a turbidity of 30 NTU or less. For higher rainfall events the discharge will range from 30-90 NTU. No turbidity measurements are available for Bush Gully Stream and O'Brien & Dunn (2007) do not provide any information on turbidity tolerances of mudfish. However, the state of Bush Gully Stream at the time of Golder Associates survey with significant damage to the streambed and stream banks indicates a potential for highly turbid flows in Bush Gully Stream. This is supported by photographs in Golder (2014, Figure 18) and Harding & McIntosh (2006, Figure 2) showing turbid water in Bush Gully Stream. Therefore, it is expected that discharges from the North ELF facility will not exceed the turbidity tolerance of the fish and invertebrate fauna in Bush Gully Stream. I

I also note that the Water Management Plan states

“in the event that water quality at CC24 exceeds trigger values the AMD adaptive management plan will default to pumping MSR effluent onto the North ELF and active mine site for dust suppression.”.

This provides an additional management option for the protection of Bush Gully Stream from any impacts from the North ELF discharge.

Conclusion

With the proposed water treatment at the North ELF facility it is expected that the fauna of Bush Gully Stream (pre drainage works) will not be impacted by the discharge.

Closing

If you have queries regarding this memo please contact Richard Allibone by phone 03-4544849, 021 904950 or by email at waterwayscon@gmail.com.

Regards



Richard Allibone