Memo

To: Cheryl Low, Environmental Manager, Matakanui Gold Ltd
From: Jens Rekker,
CC: Shay MacDonald, Senior Consent Planner, Otago Regional Council
Date: 11 March 2026
Subject: Instituting Water Quality Monitoring of Lindis River and Bendigo Creek

1 Introduction

At the 25 February 2026 workshop between Matakanui Gold and Otago Regional Council, the question of delineating the baseline and monitoring long-term surface water quality in the primary catchments downstream of the BOGP mining complex –

- During pioneering (Year 1)
- During operations (Year 2 – 13)
- Following mineral extraction closure (Active Closure)
- In Post-Closure.

1.1 Lindis River at Ardgour Road

Otago Regional Council maintains surface water quality monitoring on the Lindis River at the ORC Ardgour Road flow recorder site. This site is notable in being bounded upstream and downstream by dry riverbed during late summer low flow periods, as river water moves primarily by interflow within the hyporheic zone coarse sandy gravels of the Lindis Alluvial Ribbon Aquifer. By whatever mechanism, the subsurface flows persistently surfaces in the small river reach either side of the flow monitoring site, perhaps a low permeability geological feature beneath the perennial river reach.

ORC archives water quality on Ammonia-N, DRP, E. coli, Nitrate-N and pH for the Lindis at this site. Flow data is also available. Monthly monitoring has been instituted since September 2005, with gaps.

1.2 Lindis River at Lindis Peak

Earth Science New Zealand (formerly NIWA) maintains a flow monitoring and water quality monitoring at 'Lindis River at Lindis Peak', which is upstream of the lower river and mostly upstream of irrigation intakes that impose a substantial load upon the lower river during the irrigation season. ORC archives water quality on Ammonia-N, DRP, E. coli, Nitrate-N and pH for the Lindis at this site. Flow data is also available. Monthly monitoring that includes the above determinands has been instituted since September 2014.

1.3 Bendigo Creek

There is no independent water quality monitoring of the Bendigo Creek main stem. Proposed BOGP monitoring focuses on Clearwater Creek and the Rise & Shine Creek catchment affected by SRX and the RAS pit edge. It is proposed to institute a new main stem surface water quality monitoring site in lower Bendigo Creek upstream of points below which creek water infiltrates to the ground, and thence to the Bendigo Aquifer.

2 Historic Surface Water Monitoring

A location map of the combined surface water quality monitoring at Lindis Peak and Ardgour Road sampling sites is provided below in Figure 1.

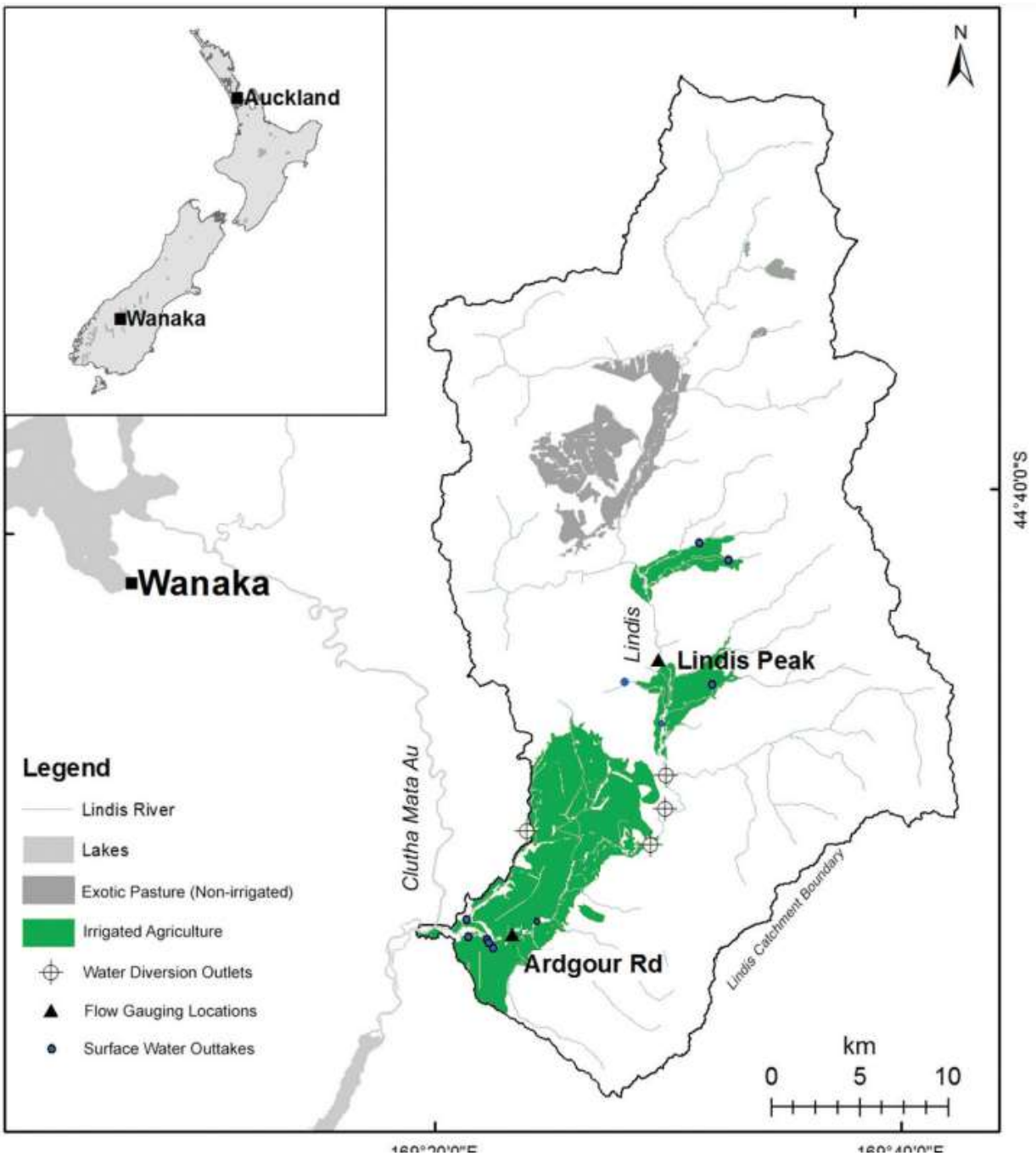

Figure 1: Location of Lindis River @ Lindis Peak, plus the downstream site of Lindis River @ Ardgour Road

Plots of the analytical results as time series are provided for each set of analytes in Figure 2, Figure 3, Figure 4, Figure 5, and Figure 6 for ammonia, DRP, nitrate, pH and E. coli, respectively. The data is presented as time series plots to display variability and any seasonal trends.

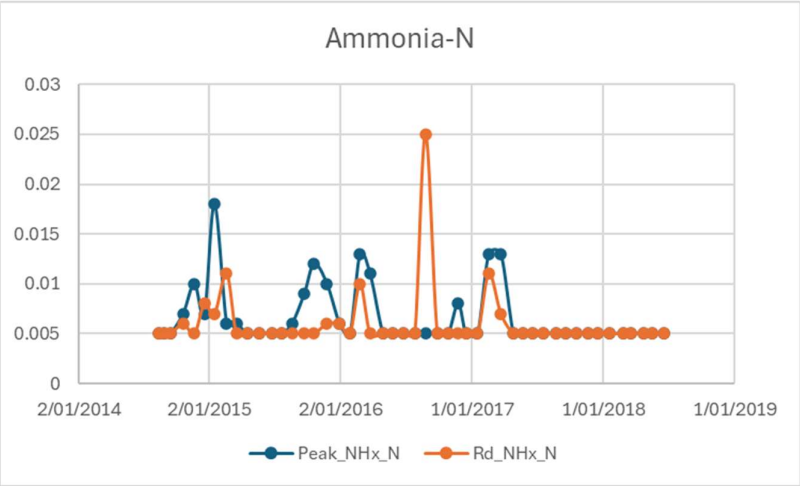

Figure 2: Ammoniacal nitrogen concentrations for Lindis Peak (Peak) and Ardgour Road (Rd)

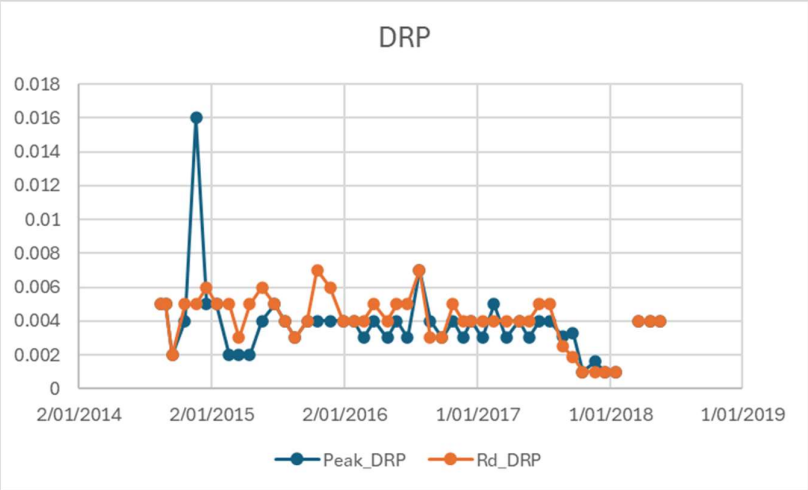

Figure 3: DRP concentrations for Lindis Peak (Peak) and Ardgour Road (Rd)

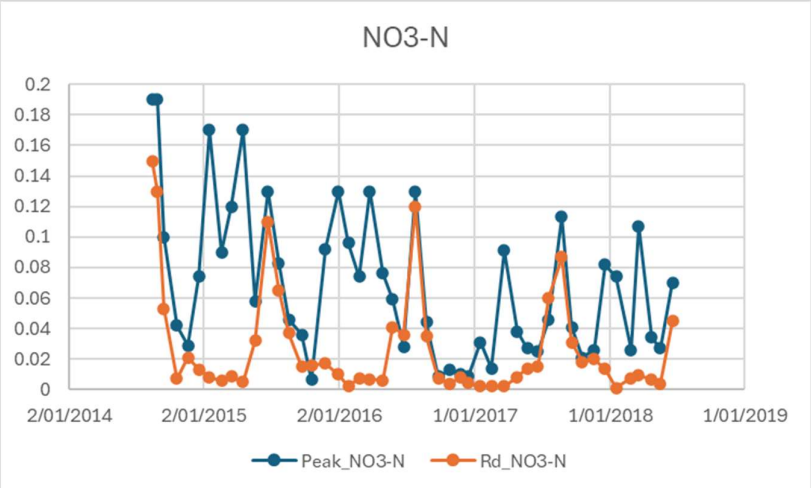

Figure 4: Nitrate nitrogen concentrations for Lindis Peak (Peak) and Ardgour Road (Rd)

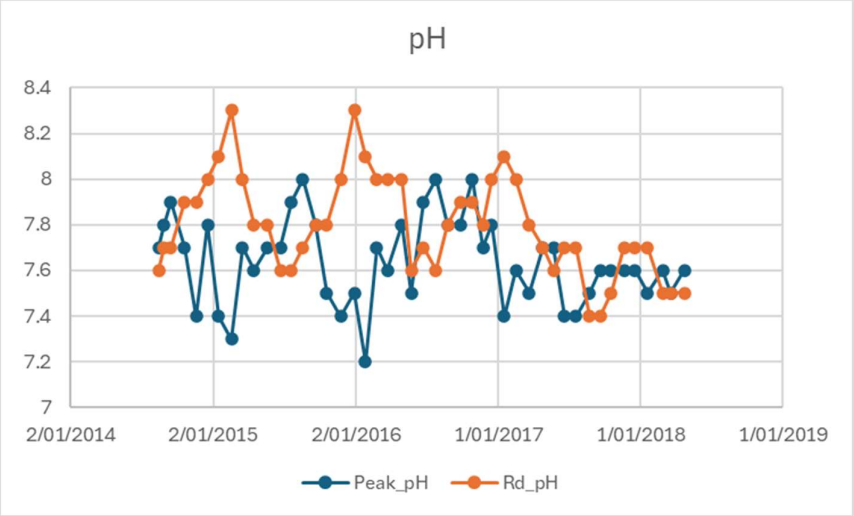

Figure 5: pH levels for Lindis Peak (Peak) and Ardgour Road (Rd)

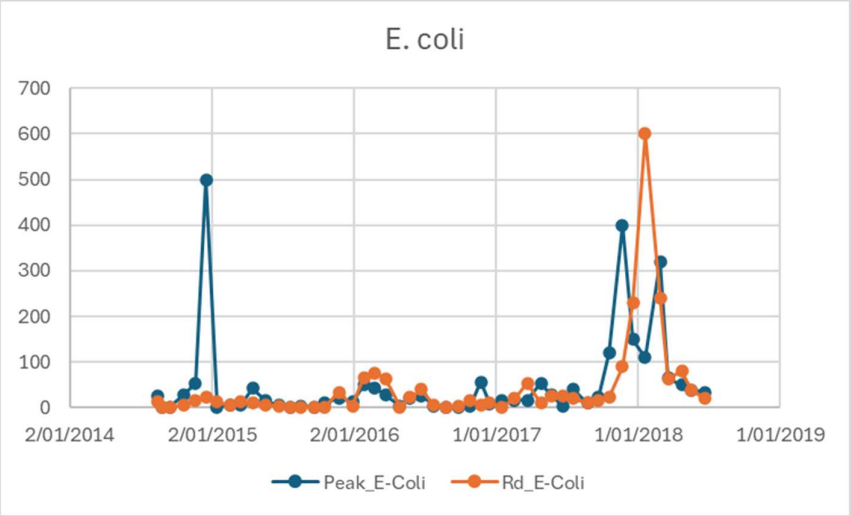

Figure 6: E. coli concentrations for Lindis Peak (Peak) and Ardgour Road (Rd)

The sole determinand that appeared to display consistent seasonal dependencies was nitrate nitrogen. Expanding on nitrate nitrogen plot in Figure 4, two plots were prepared of river nitrate nitrogen concentration alongside measured daily river flow at Ardgour Road monitoring site. Figure 7 plots a time series of nitrate at both Lindis Peak and Ardgour Road sampling site, alongside the measured mean daily flow rate. The distinction between the upstream schist rock dominated catchment of the Lindis Peak site and the downstream alluvium dominated catchment of the Ardgour Road site is probably the larger degree of groundwater-mediated baseflow at Ardgour road. Due to the large porous reservoir of alluvium immediately upstream of the flow and sampling monitoring site at Ardgour Road.

Figure 7 reveals nitrate nitrogen concentrations at Ardgour Road following the trend of flow rate, while the nitrate nitrogen concentration at Lindis Peak was markedly more volatile. Figure 8 reveals a strong pattern of dependence between flow rate and nitrate nitrogen concentration at Ardgour Road. It is inferred, based on studies in comparable braided river bed catchments, that nitrate accumulates in upstream alluvium and is flushed into surface water through to the river water column by high flows. Low flows are period of declining nitrate nitrogen concentration and depletion of the upgradient nitrate reservoir.

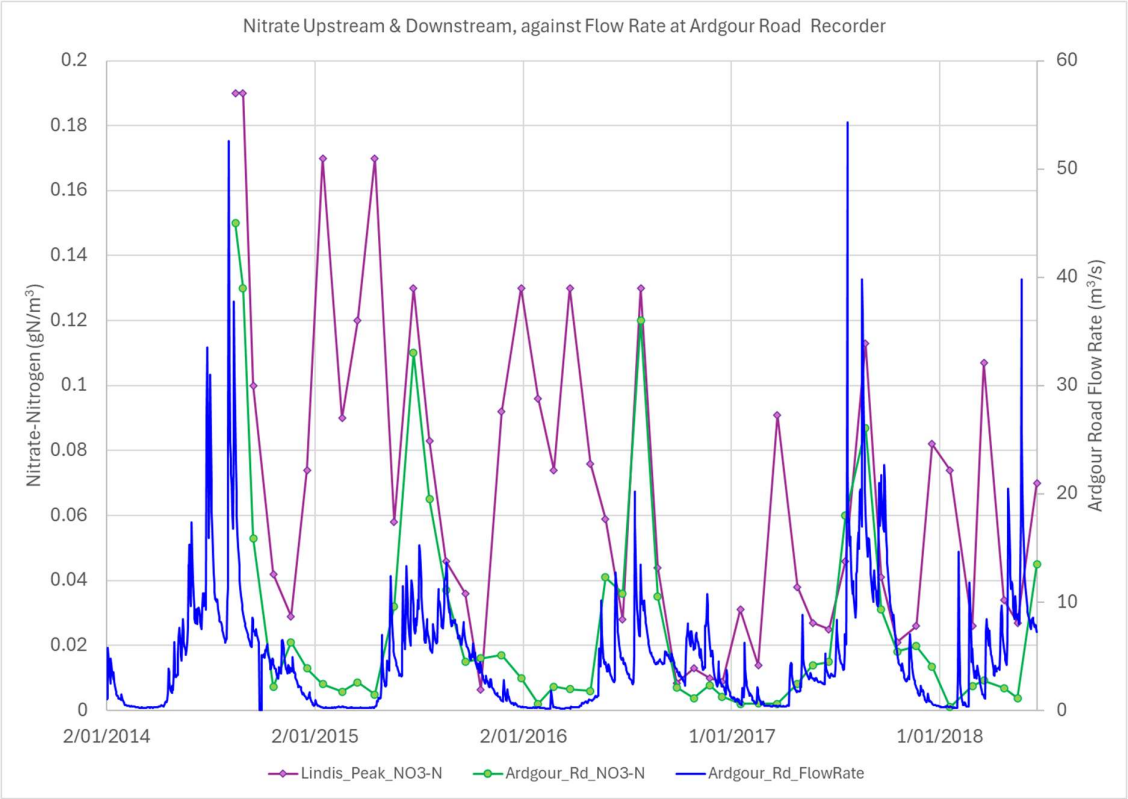

Figure 7: Trends in monthly nitrate-N at Lindis Peak and Ardgour Road daily mean measured flow rate

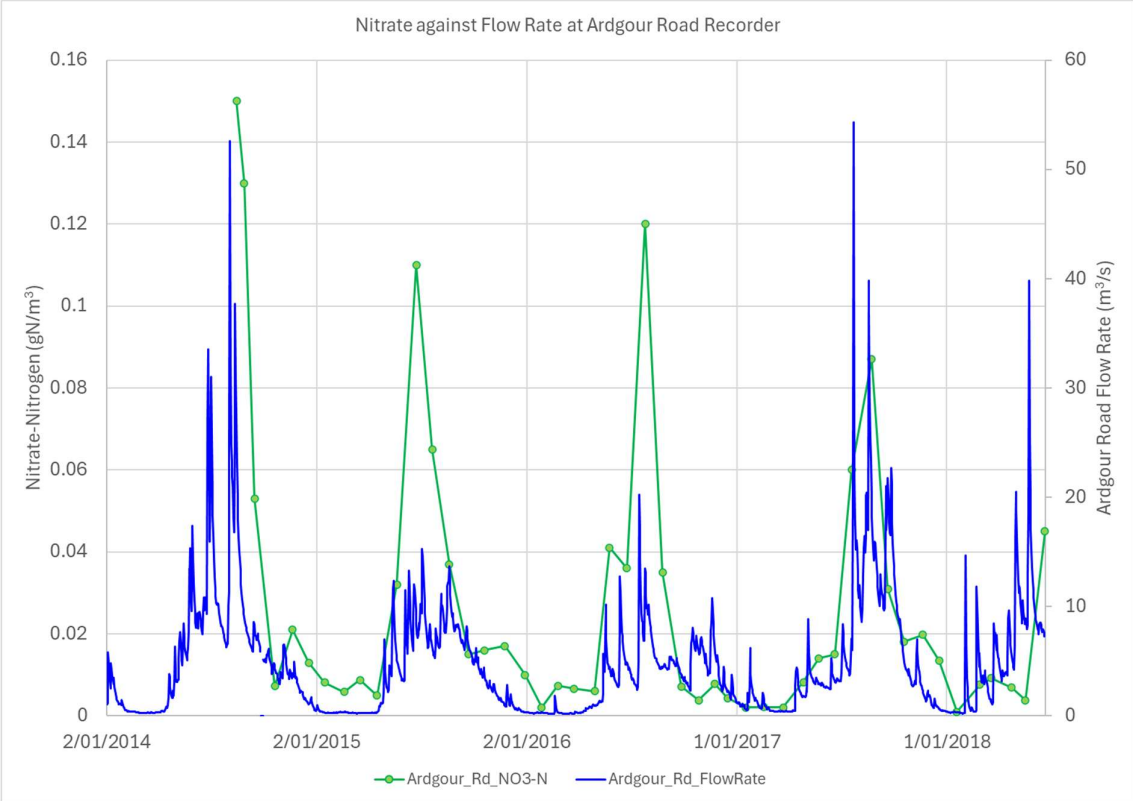

Figure 8: Ardgour Road monitoring site nitrate-N concentration and measured mean daily flow rate

Pastoral land use is the predominant inferred source of nitrate, which nitrifies in the soil profile and moves readily dissolved in soil water and groundwater to the Lindis Alluvial Ribbon Aquifer (LARA). The LARA ultimately discharges into the Lindis River before its confluence with the Clutha River, but particularly into the river bed immediately upgradient of the Ardgour Road monitoring site.

Dissolved inorganic nitrogen moves through the Lindis River primarily as nitrate, with ammonia about an order of magnitude lower in concentration and therefore mass load. This pattern is consistent with the mostly oxic geochemical characteristics of the gravelly alluvium making up the majority of upgradient subsurface vectors of catchment drainage. Nitrate nitrogen is generally associated with high velocity groundwater flow within high effective porosity, high permeability, and elevated dissolved oxygen content through the ground and hyporheic zone. Ammonia in groundwater is more generally associated with low velocity water flow within low effective porosity, moderate to low permeability, and suppressed dissolved oxygen content through the ground or wetlands.

3 Implications for Ongoing Monitoring

In the Shepherds Creek and lower Lindis River catchments, the BOGP operational and post-closure water quality risks include the multiple mode surface – subsurface – surface water vectors for potential contaminants such as arsenic, sulphate, nitrate, and other dissolved metals. The Lindis Valley water quality monitoring does not include sulphate but does include nitrate nitrogen. Other dissolved metals and metalloids have not been defined in existing monitoring.

Monitoring of nitrate has indicated that the baseline is influenced by volatility in the winter and spring season associated with high river flow rates and depletion with relative stability in concentrations associated with low river flows over the irrigation season and elevated evapotranspiration.

4 Proposal for Future Monitoring with Matakanui Gold involvement

4.1 Monitoring Sites

It is proposed that surface water monitoring with an expanded and focused list of analytes should be undertaken as follows:

1. Continuation of monthly monitoring of the Lindis River at Ardgour Road
    a. Consideration could also be given to the installation and maintenance of a continuous optical nitrate sensor for further spatial characterisation of ambient solute concentration trends.
2. Implementation of new monthly monitoring of Bendigo Creek at grid reference1314160 5018620 metres NZTM.

The Lindis River site would coincide with the ORC monitoring site in the lower river. The Bendigo Creek site would coincide with the Bendigo Station flow monitoring site that is a residual flow monitoring site for consent RM20.079.01 issued to Bendigo Station. This location coincides with a track crossing and ford, affording light vehicle access. The creek is considered to have perennial flow character at this proposed sampling site, which avoids the tenancy of lower reaches to lose creek flow during late summer.

Figure 9: Proposed surface water monitoring site at "Bendigo Creek monitoring station" (Bright, 2020)

Both proposed monitoring sites are collocated with existing flow measurement equipment. The ability to correlate the results of analysis with flow conditions is helpful in interpreting the concentrations or trends. Mass loads may also be calculated.

4.2 Analytes

The list of analytes would conform with the parameters and limits specified in Table 3 of the BOGP Water Management Plan.

4.3 Sampling Frequency

Monthly sampling and analysis frequency is proposed. As the basic objective of the surface water quality monitoring at Lindis River and Bendigo Creek is conjunctive assimilated catchment condition rather than trigger compliance limits, sampling frequency needs merely to characterise temporal trends in any seasonal fluctuation pattern. With such seasonal patterns characterised, the effects of upstream mining activities could be estimated in the context of downstream infiltration to groundwater. Both the Lower Lindis River and the lower Bendigo Creek contribute to groundwater sustaining irrigation galleries and bores operated during the 6 – 7 month irrigation season (October to April).

ENDS

Table 1: List of Analytes

Analyte
pH
Turbidity
Ammoniacal Nitrogen
Nitrate Nitrogen
Cyanide
Sulfate
Aluminium
Antimony
Arsenic
Cadmium
Chromium
Cobalt
Copper
Molybdenum
Zinc

Note: Green shading indicates overlap with ORC Lindis River monitoring analytes.

5 Reference

Bright, C. (2020). *Hydrological assessment for flow losses / gains—Bendigo Creek* (Technical Comment No. S15298). Landpro.