EVIDENCE OF GREG RYDER

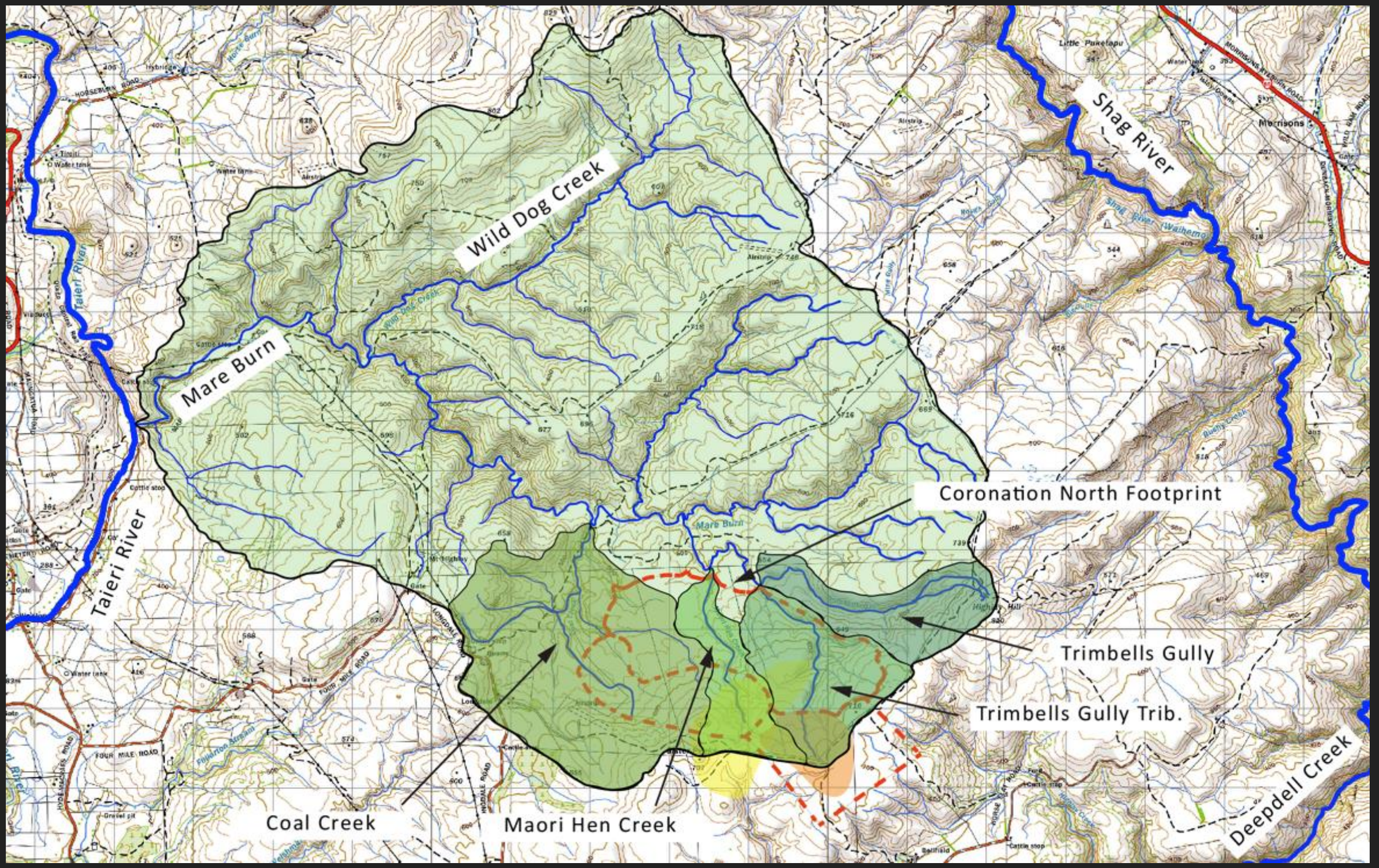
CORONATION NORTH PROJECT

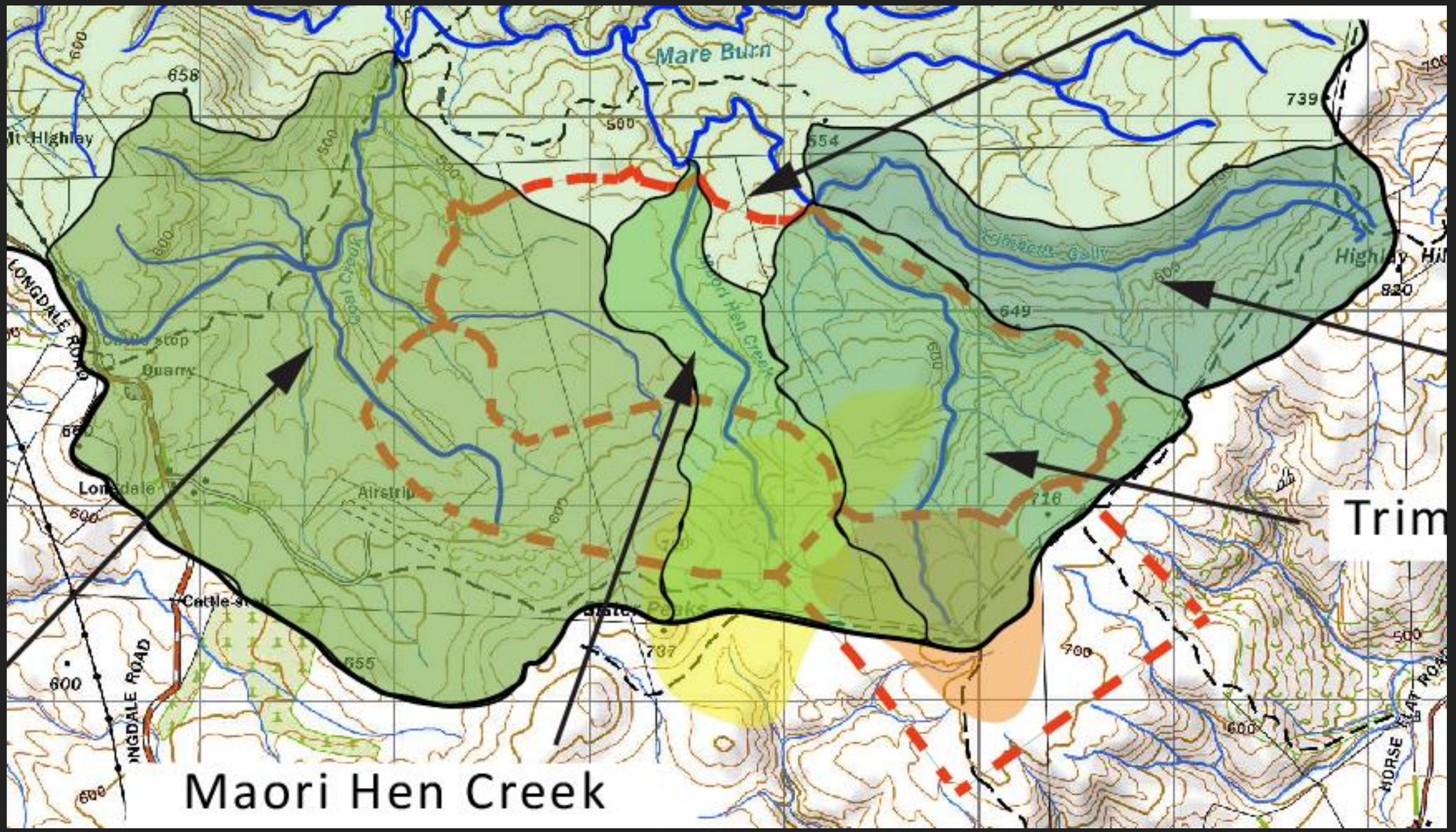
SCOPE OF EVIDENCE

- A summary of information on aquatic values in the Coronation North Project area;
- An assessment of potential effects of the Project on aquatic values;
- Recommendations on options for mitigating any significant effects on aquatic values;
- Recommendations on monitoring and consent conditions;
- Consideration of submissions raising issues relating to aquatic ecology; and
- Some additional comments on the s42A report and associated discussions.

AFFECTED CATCHMENTS

- Trimbells Gully Tributary
- Maori Hen Creek
- Coal Creek
- Mare Burn
- Affected sub-catchments first surveyed in 2011 and 2012.
- Most recently, surveys for consenting purposes occurred between November 2015 and April 2016.


Wild Dog Creek
Mare Burn
Shag River
Taieri River
Coronation North Footprint
Trimbells Gully
Trimbells Gully Trib.
Coal Creek
Maori Hen Creek
Deepdell Creek


Mare Burn
Maori Hen Creek
Airstrip
Quarry
Cattle Stop
Trim

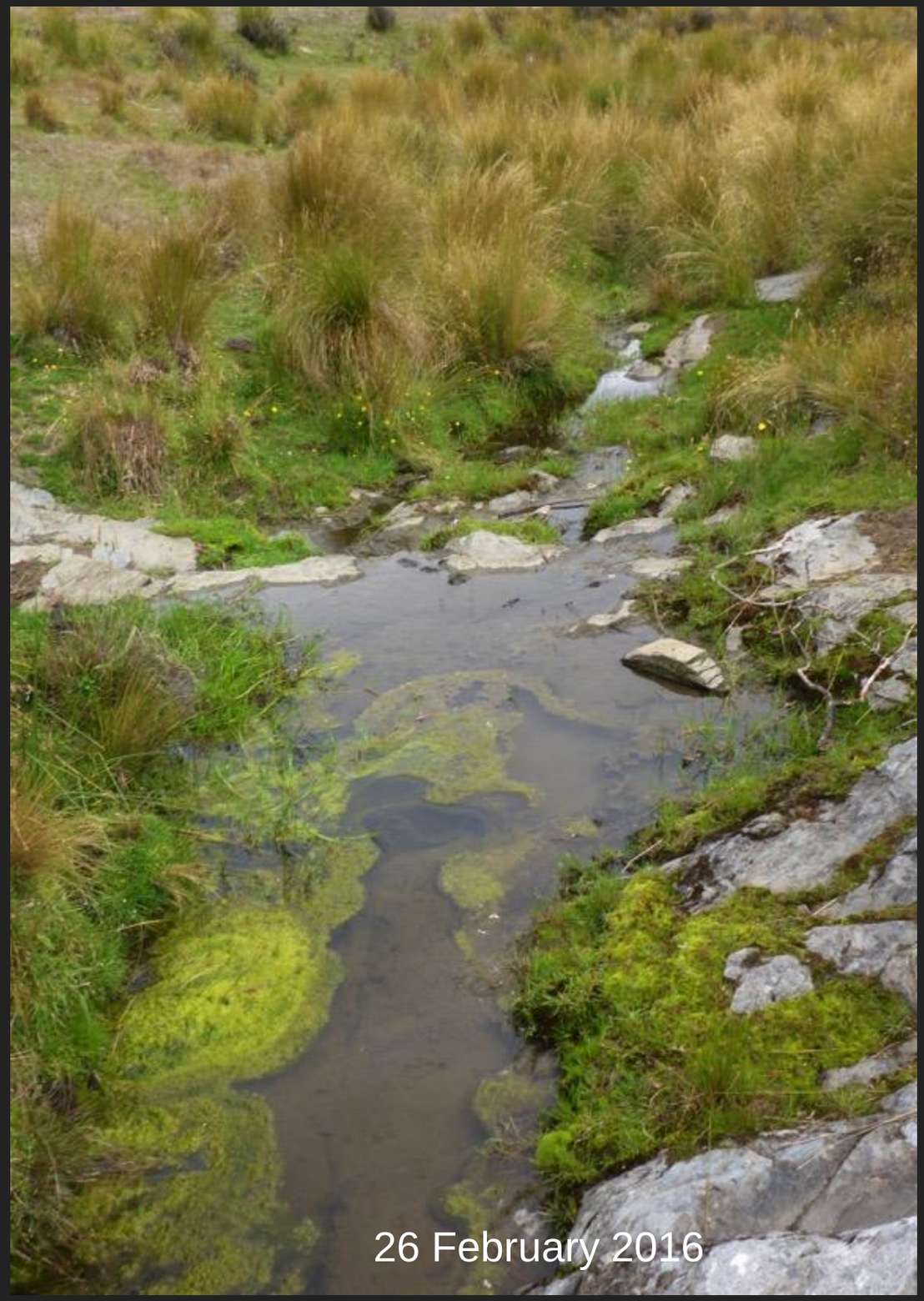
TRIMBELLS GULLY TRIBUTARY

- The existing footprint of the Coronation mine lies in the headwaters of Trimbells Gully Tributary. This tributary drains a catchment of 250 ha representing about 3.9 % of the total Mare Burn catchment.
- The February 2016 survey estimated the flow to be less than 0.5 L/sec. Small pools remained in places, however in some sections surface water was barely visible.
- Crayfish are common throughout most of the creek's length. Adults and juveniles are observed in most sections often. Galaxiids are also common.

EVIDENCE OF G. RYDER

TRIMBELLS GULLY TRIBUTARY

26 February 2016



26 February 2016

MAORI HEN CREEK

- Lies within a relatively narrow gully with steeply-sided faces throughout most of its length. Catchment area of 152 ha representing about 2.4 % of the total Mare Burn catchment.
- The Coronation North Project would envelope almost the entire catchment of Maori Hen Creek.
- Crayfish observed in small pools throughout the creek, and both galaxiids and crayfish common in downstream pools.
- Stock damage to the channel particularly in the lower reaches.

EVIDENCE OF G. RYDER

MAORI HEN CREEK

21 December 2015

26 April 2016

COAL CREEK

- Catchment (700 ha) is greater than the total area occupied by the Maori Hen, Trimbells Gully and Trimbells Gully Tributary catchments.
- Evidence of historic mining activity and channel realignment over time.
- Gully floors & associated watercourse channel subject to extensive trampling and pugging by stock.
- Despite physical disturbance, galaxiids and crayfish were common throughout the mid reaches in April 2016.
- Galaxiid larvae were observed in the bottom reach in December 2015, however by late February 2016, the flow in this reach had ceased and the channel was completely dry.
- Some tributaries in the mid catchment were dry in April 2016.

EVIDENCE OF G. RYDER

COAL CREEK

21 December 2015

26 February 2016

EVIDENCE OF G. RYDER

COAL CREEK

EVIDENCE OF G. RYDER

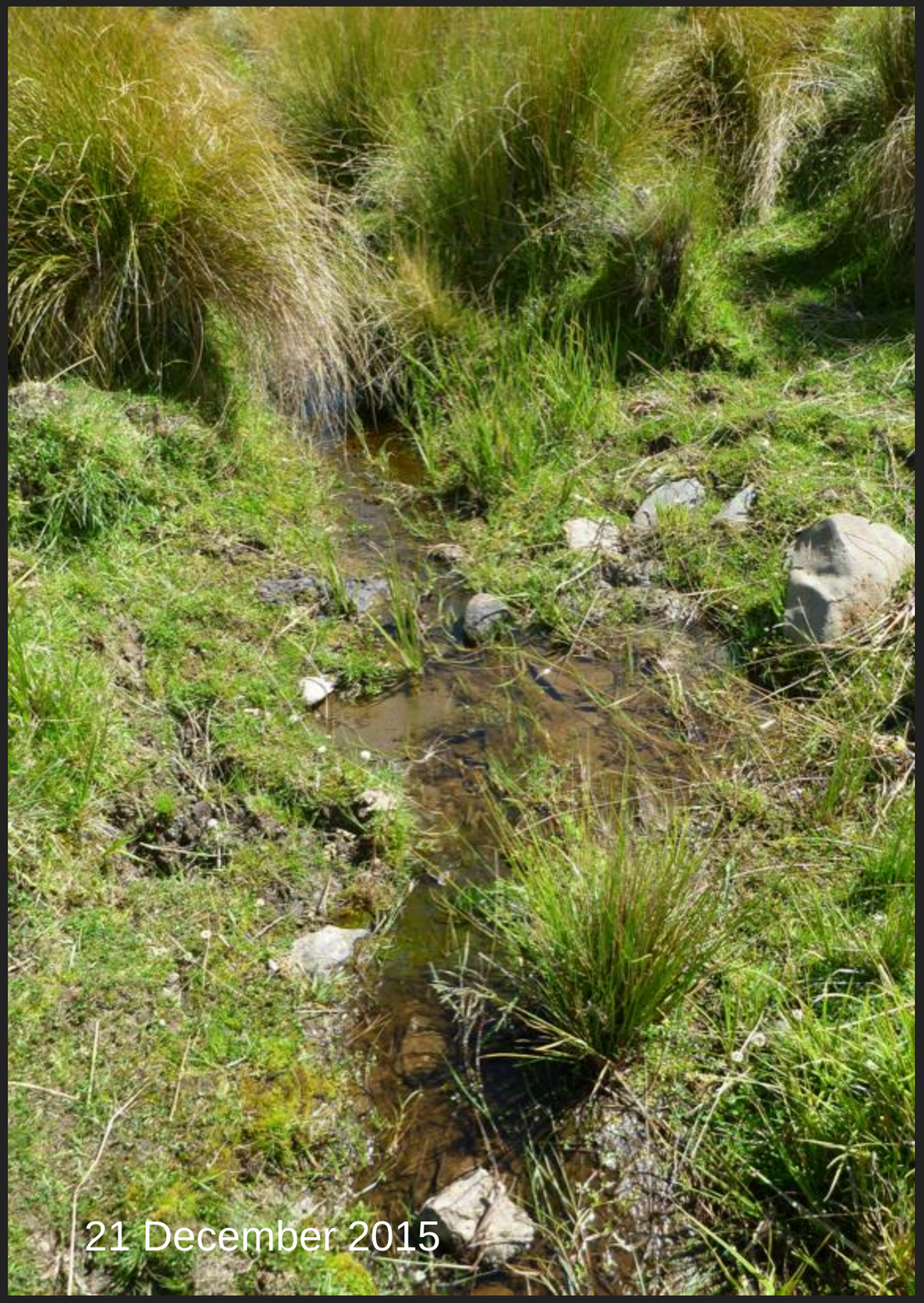
COAL CREEK

TRIMBELLS GULLY

- Outside of the Coronation North project footprint.
- Very small flow in December 2015 (0.1-0.15 L/s) and virtually dry in February 2016.
- The December survey found crayfish and juvenile galaxies in the lower reaches.
- Sections containing fish in December 2015 were dry in February 2016.

EVIDENCE OF G. RYDER

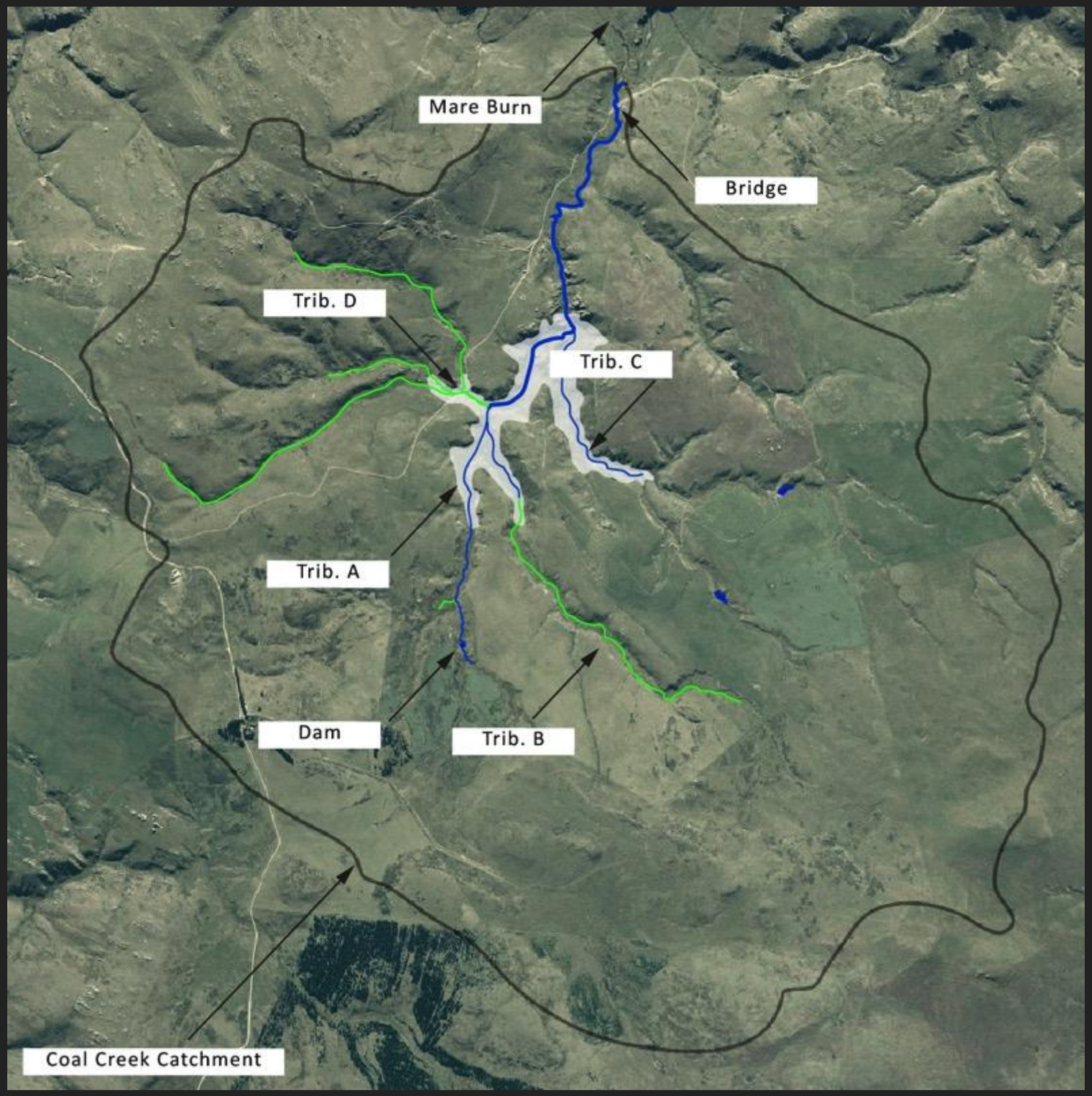
TRIMBELLS GULLY



21 December 2015

26 February 2016

PROPOSED COAL CREEK FRESHWATER RESERVOIR



Reservoir Footprint

Dry/No Surface Flow

Wet/Surface Flow

COAL CREEK RESERVOIR

- Loss of approximately 1.5 - 2 km of small stream and ephemeral stream habitat of relatively poor quality.
- When full, the reservoir would have an average depth of about 0.5 m, indicating that a significant proportion of it would be very shallow, but towards the dam face the water depth reaches up to 20 m.
- Some risk of thermal stratification at times of the year with low oxygen water in the deeper part of the reservoir, although potential effect reduced by drawdown.
- OceanaGold intend to use a floating decant system to enable oxygenated water from the surface of the reservoir to be discharged. Aeration also to be enhanced.

WATER QUALITY EFFECTS: GENERAL

- Over two decades of surface water monitoring at the Macraes Gold Project.
- Background water clarity is usually good with no evidence of water clarity declining over time as a result of mining, and no obvious surface sediment accumulation.
- No long-term downward trend in galaxiid abundance in the surveys I and my colleagues have conducted at the Macraes Gold Project area since the 1990s.
- Galaxiid populations are present in locations where mine impacted water discharges occur, for example Murphy's Creek and Deepdell Creek.
- No existing sulphate toxicity data for Taieri Flathead galaxias or any of its close relatives (other Otago non-migratory galaxiids) to inform the setting of sulphate toxicity limits.
- Toxicity trials recommended to help our understanding of the species' sensitivity to sulphate.

PROPOSED MITIGATION

- Loss of fish habitat
  - Have previously recommended translocation of fish and crayfish where their habitat was likely to be lost or significantly affected by mining.
  - Guaranteeing a successful translocation outcome is difficult.
  - Habitat creation and protection in areas that already support flathead galaxiid populations are worth exploring further. E.g., the establishment of trout barriers.
  - Fence the Coal Creek freshwater reservoir from stock and develop ungrazed riparian margins.
  - The proposed minimum flow of 5 litres/second released from the proposed Coal Creek reservoir may improve downstream galaxiid habitat in the lower Coal Creek catchment and in the Mare Burn.
- Loss of crayfish habitat
  - Crayfish inhabit both stream and pond environments. Their population can be maintained and enhanced through habitat creation (e.g., man-made ponds).
  - Crayfish and flathead galaxiids co-exist in tributaries of the Mare Burn, and so any mitigation provided for these fish are likely to have benefits for local crayfish populations as well. A number of small ponds already exist in the Coal Creek catchment. These could be protected and enhanced to improve habitat for crayfish. De-stocking the catchment would have significant benefits to pond and stream habitat. Such measures would also act to improve downstream water quality.

PROPOSED MITIGATION

- Sediment mobilisation and run off
  - Erosion and sediment control measures will be utilised for the Coronation North project.
- Accidental contaminant spills
  - Addressed by an on-site contaminant management plan.
- Nuisance aquatic weed/algae introduction
  - OceanaGold complies with notices and guidelines issued by Biosecurity New Zealand regarding didymo and this practice would continue for Coronation North.
- Proposed aquatic biological monitoring & investigation
  - Proposed monitoring will be undertaken at a new site MB02, provided suitable habitat is available for sampling. Monitoring of stream macroinvertebrates and periphyton will continue to be carried out quarterly and fish will continue to be surveyed annually. Compliments existing surface water monitoring programme at Macraes.
  - Proposed chronic and acute toxicity testing trials to determine the appropriate toxicity concentration protection thresholds for Taieri flathead galaxias.