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Issues and design considerations when negotiating fish passage at everyday road causeways

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Causeways: problematic structures for fish passage

- Effectively low head weirs - problematic for fish passage, particularly Australian native fish
- What are the issues and considerations, and how do we fix them?

Key message

Finding a low cost, practical means of improving fish passage at existing everyday road causeways is often difficult to achieve

Why causeways are bad for fish

Fish passage:

- Little capacity for water to flow through structure
- Sheet flow over top of structure
- Waterfall effect on downstream side

Stream morphology:

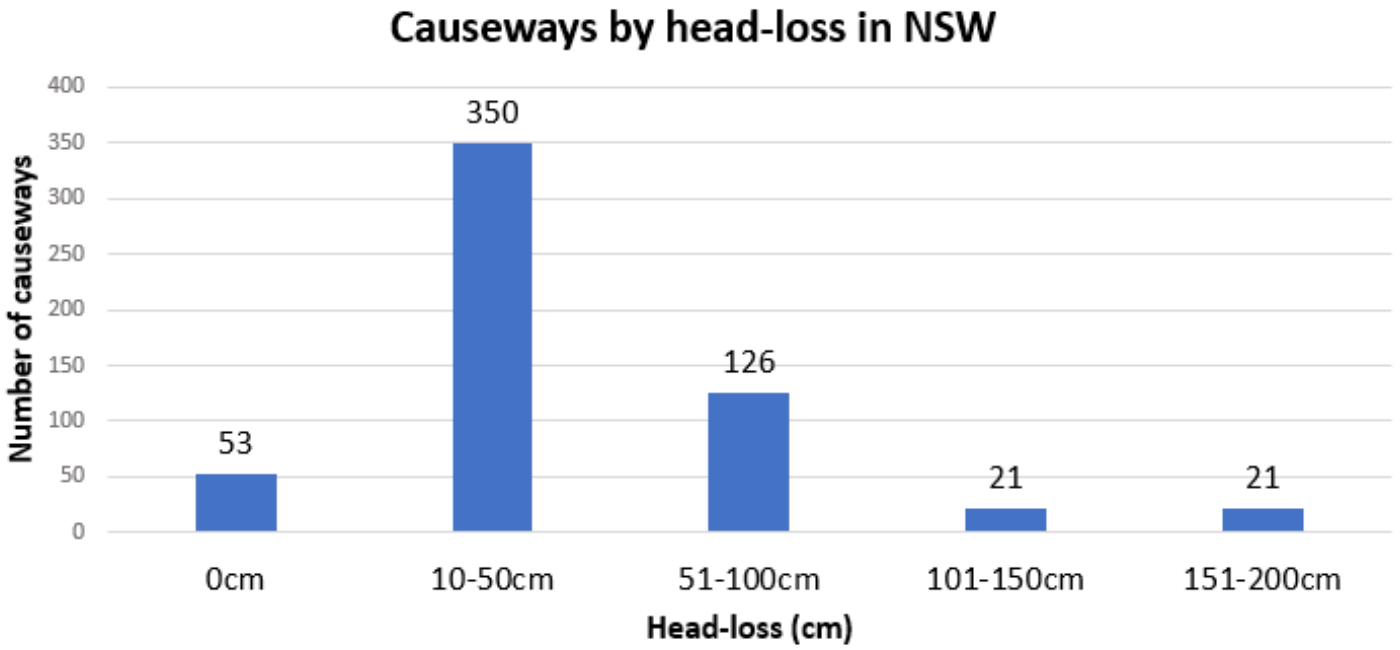
- Weir pool on upstream side
- Sediment deprivation on downstream side

Other causeway issues

- Most are owned by private individuals or local councils.
- Most council-owned structures are in regional LGAs with low rate payer base, large road network and high number of causeways with most only servicing minor roads and/or small number of residents.
- Most causeway works are short term, low cost maintenance or repairs to increase serviceability and life of existing structures.
- Very few complete causeway replacement projects with greater budgets that are able to replace with best practice structures like bridges.

How big is the problem?

- 500+ causeways in NSW with head-loss greater than 100mm



Improving the problem

- No funding to fix all at once
- Some government agencies have legislation allowing for fish passage to be considered during causeway maintenance, upgrade or replacement works
- NSW *Fisheries Management Act 1994* – s218 and 219 fish passage provisions:

  - s218: *"Minister may require a person who constructs, alters or modifies a dam, weir or reservoir on a waterway to carry out such works to enable fish to pass through or over the dam, weir or reservoir"*

  - s219: "*Fish passage not to be blocked*"

- Impacts to fish habitat also considered during assessment
- Often quick turn-around required & low budget = no complex planning, CFD modelling etc.
- As most causeway works are maintenance or repairs on a small budget, a simplistic and pragmatic approach to fish passage is required

Assessment considerations

- Is the causeway required?
- Biology (level of fish passage is required)
- Hydrology / style of waterway
- Budget and timeframes
- Condition and design of causeway
- Design difficulty and available expertise
- Effect on stream geomorphology
- Leverage from other projects

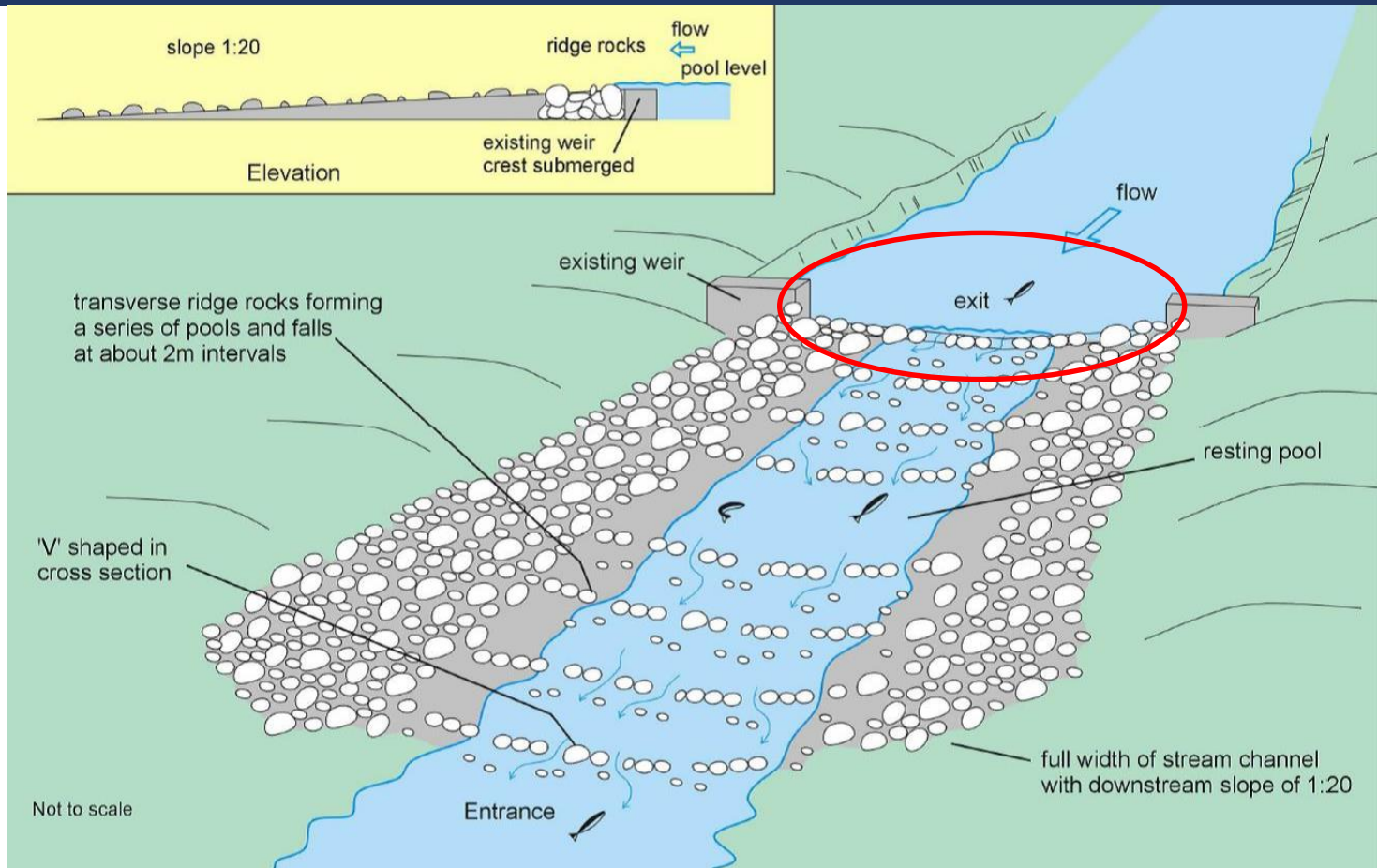
Common fish passage treatments on causeways

- Full-width rock ramp fishways
- Partial width rock ramp fishways
- Partial width rock ramp fishways with small, shallow, low-flow box culvert

- Treatments have had good success, particularly when installed on weirs
- Difficulties arise when installing these structures on causeways generally because of fundamental difference in purpose between weirs and causeways which is causeways are required to pass vehicles across waterway
- This difference can be beneficial i.e. causeways do not need to impound water

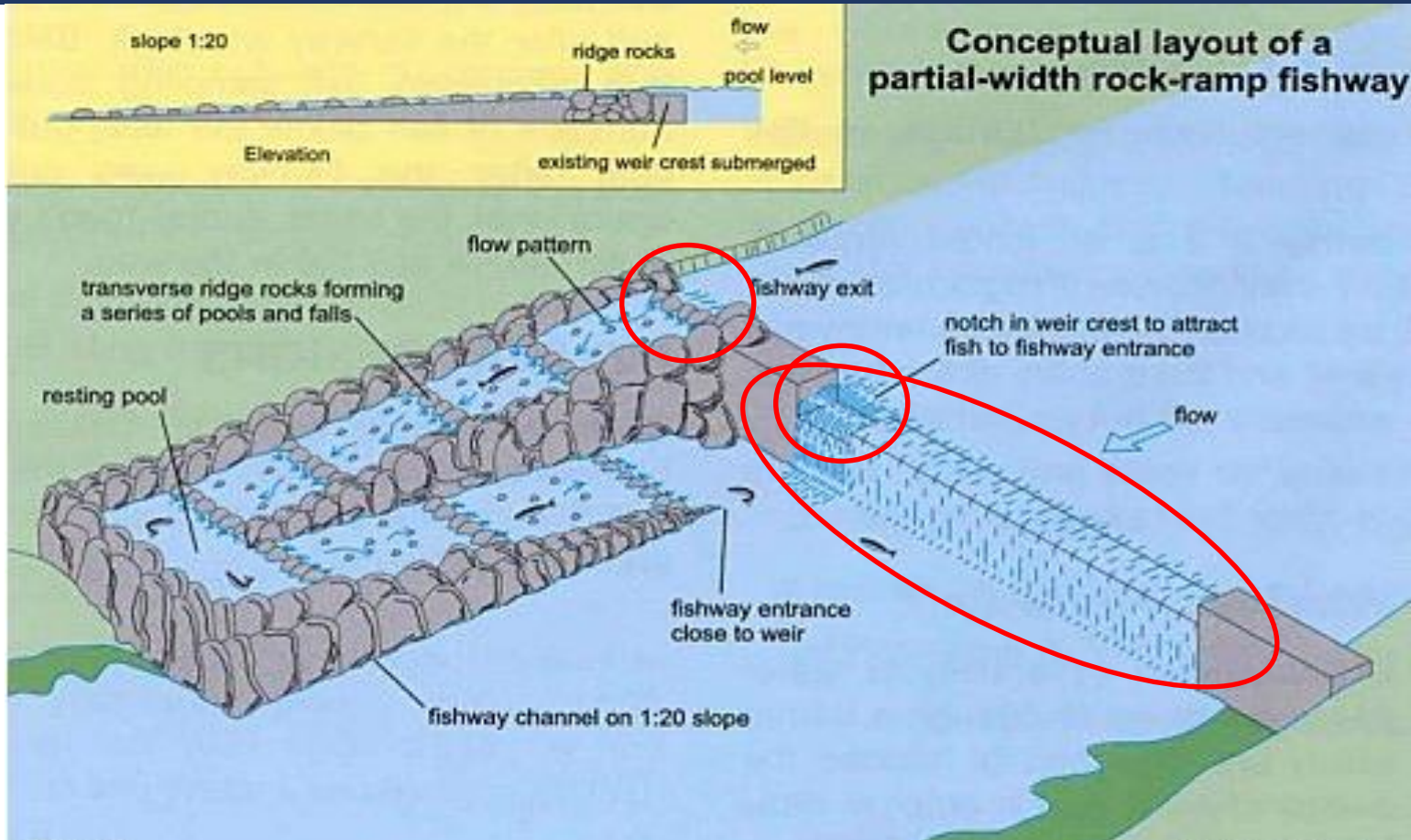
Full-width rock ramp fishway: limitations

- “V” shaped cross section: dip in driving surface OR elevation of fishway edges both problematic for vehicle safety
- Complicated to construct, particularly pool and step fishways
- Continued geomorphological issues



Partial-width rock ramp fishway: limitations

- Two low points on road surface (fishway exit and attraction flow) = Safety risk for vehicles
- Fishway entrance masked by competing flows
- Continued morphological issues



Partial-width rock ramp fishway with shallow low-flow box culvert: limitations

- Complex and difficult to construct
- Poorly located attraction flows
- Sedimentation of resting pool & debris build-up in culvert = high maintenance
- Continued morphological issues

Recent causeway upgrade: Sawyers Gully Road, Tenterfield Creek

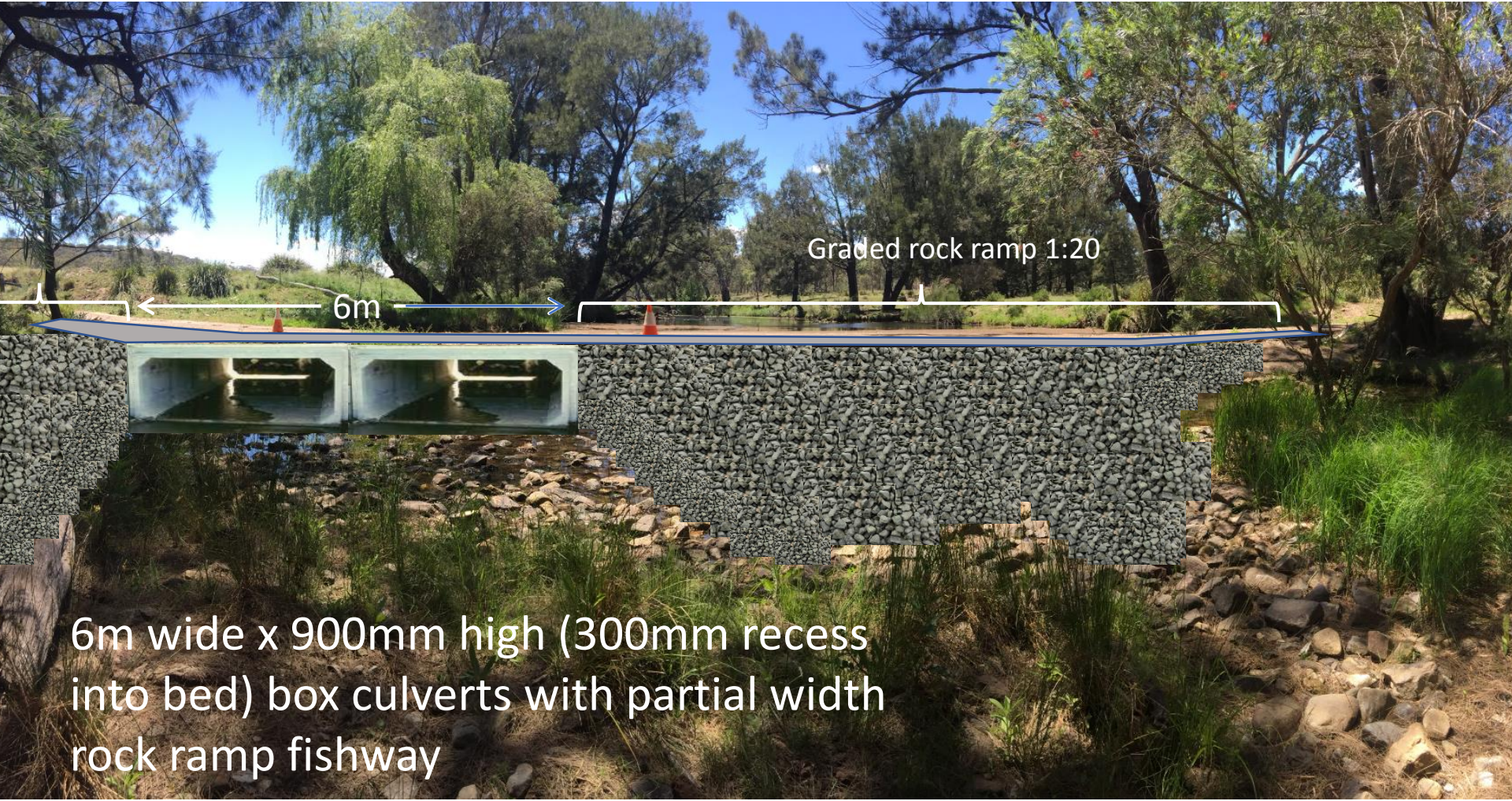
<u>Asset owner priority:</u>
Low-cost repair to keep causeway operational

<u>DPI Fisheries priority:</u>
Significant improvement in fish passage

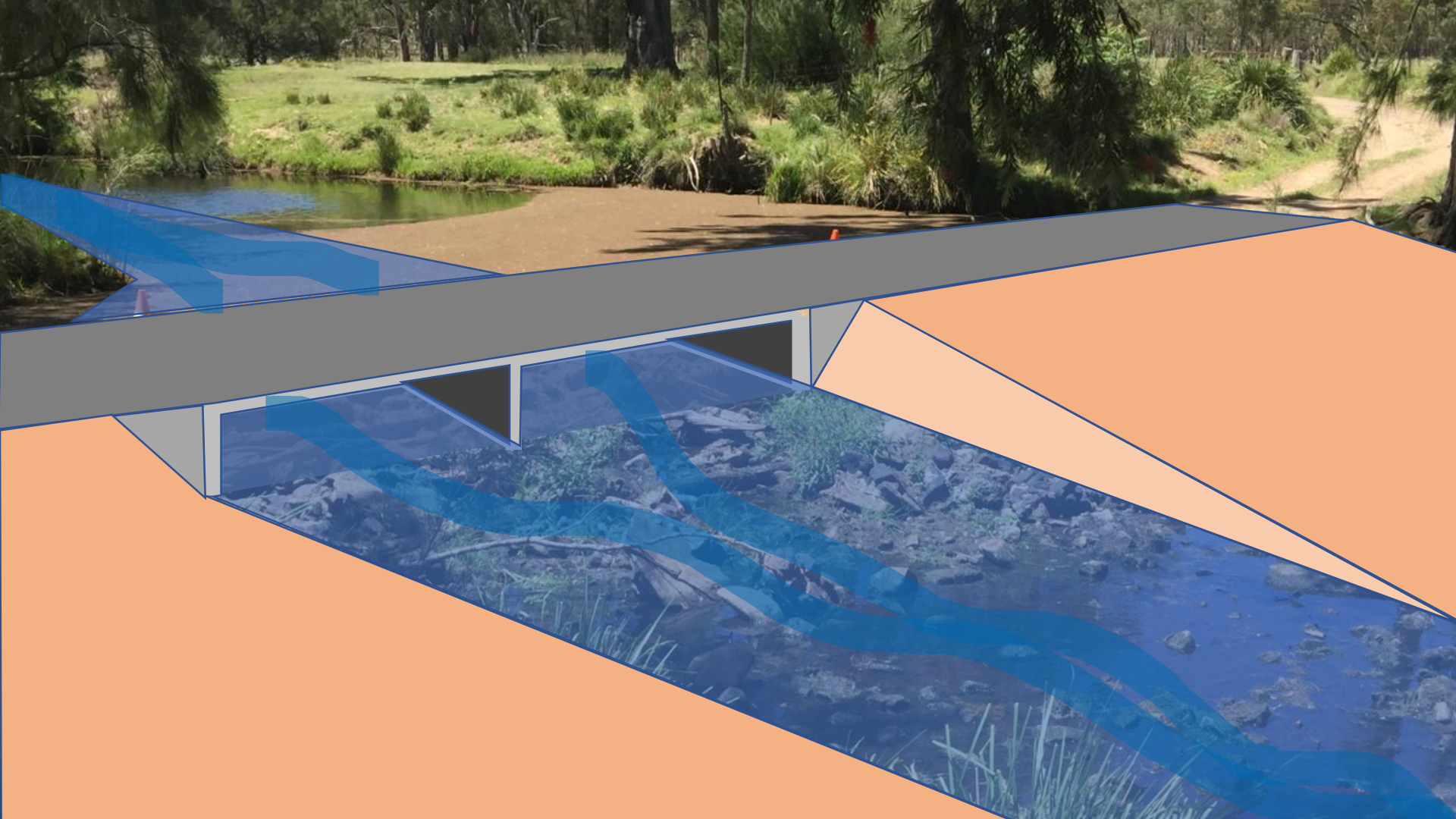
Sawyers Gully Road: initial negotiation

- Bridge too expensive
- Full-width or partial-width rock ramp not suitable due to Council safety concerns regarding dip in road surface
- Low-medium flow, full-depth box culvert with partial width rock ramp fishway: initially not favourable because of socially significant weir pool and cost
- Weir pool: Council undertook public survey – not as significant as first thought
- Cost: Leveraged relaxations on previous projects and Council received funding from natural disaster relief funding
- Result: Agreed to low-medium flow, full-depth box culvert with partial width rock ramp


~18m
~4m



6m wide x 900mm high (300mm recess into bed) box culverts with partial width rock ramp fishway



Sawyers Gully Road: summary

- Final design will improve fish passage at site particularly during low to medium flows
- The design:
  - is cost effective compared to a bridge
  - quick to design and simple to construct
  - is relatively maintenance free from a fish passage point-of-view
  - improves geomorphic heterogeneity
  - will be safe for road users, and
  - will provide greater level of flood immunity for crossing
- The project is a good example of positive collaboration between the regulator and asset owner leading to a positive outcome for fish passage.

Fish passage at causeways: conclusion

- Rectification of legacy fish passage issues associated with causeways and other road crossing barriers is a long process
- No one-fit solution – many considerations
- Asset owners commonly have minimal funds and short timeframes
- Assessment agencies have short assessment timeframes and often multiple competing projects
- Causeway works benefit from involvement of fish passage experts
- **Finding a low cost, practical means of improving fish passage at existing causeways is achievable but requires careful consideration of a range of factors and careful negotiation with asset owners**

Questions