

Fishways



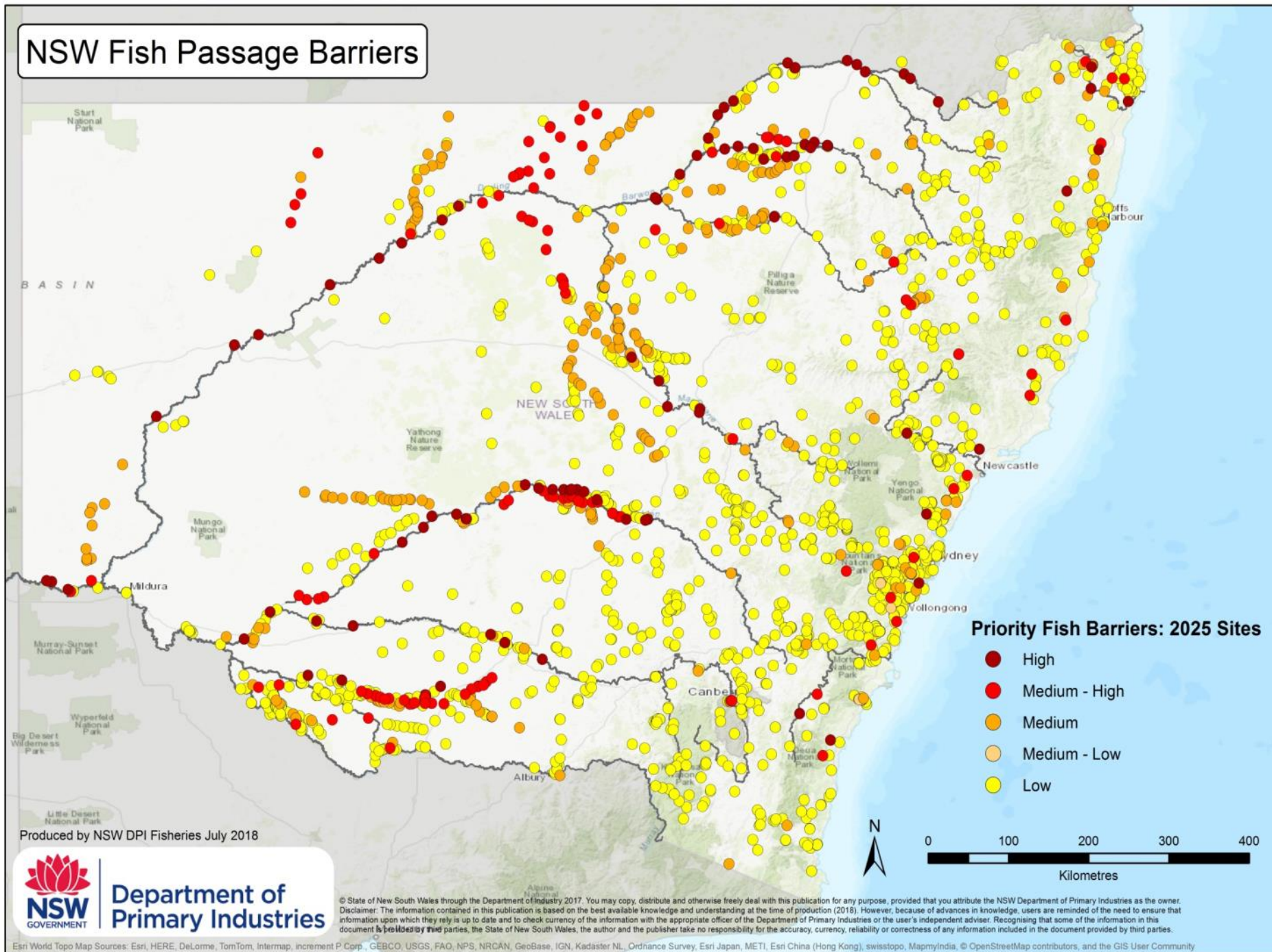
Design challenges & opportunities

1st August 2018



Department of
Primary Industries

NSW Fish Passage Barriers

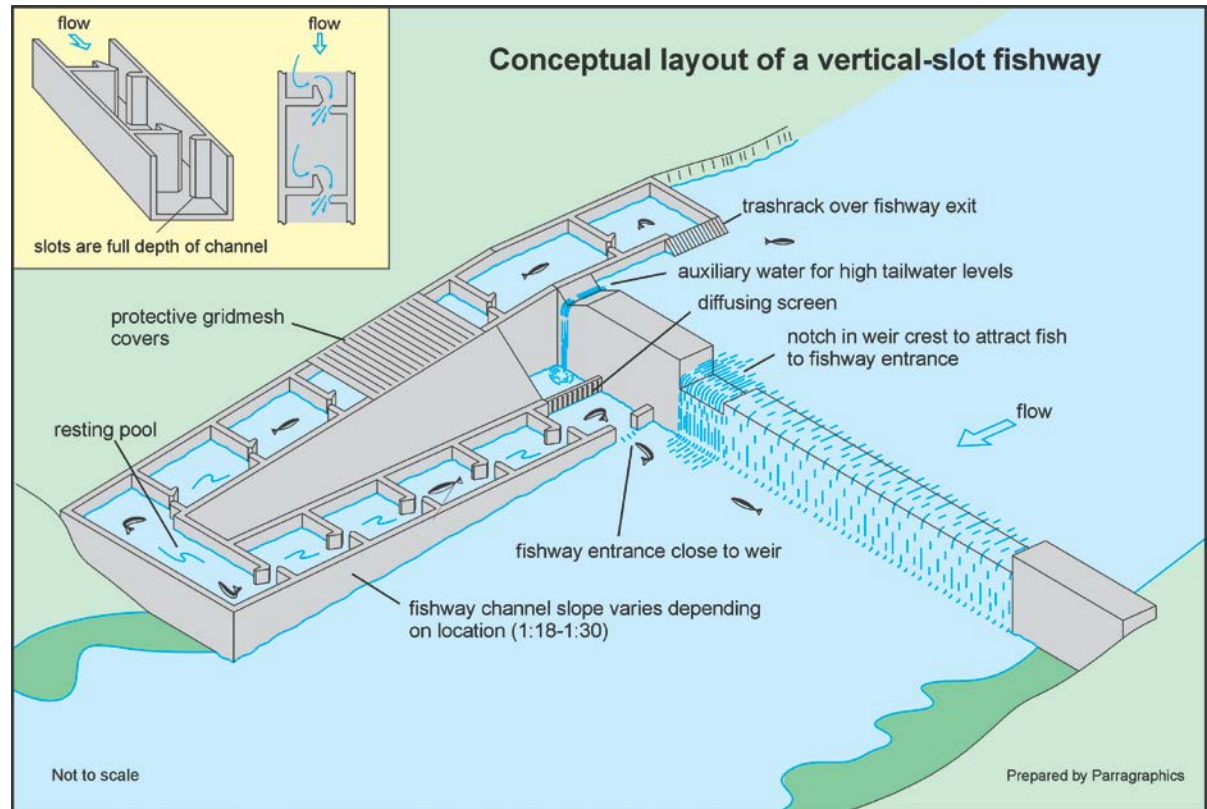


Section 218 of FM Act 1994

- An asset owner who constructs, alters or modifies a dam, weir or reservoir must, if the Minister so requests, construct a suitable fishway.
- The Minister may also require a fishway asset owner to carry out repairs – ongoing O&M requirement.
- Intent - acknowledges legacy deleterious impact of instream structures on fish passage, and over time bring about their remediation when significant asset refurbishment occurs.

“Suitable” Fishways

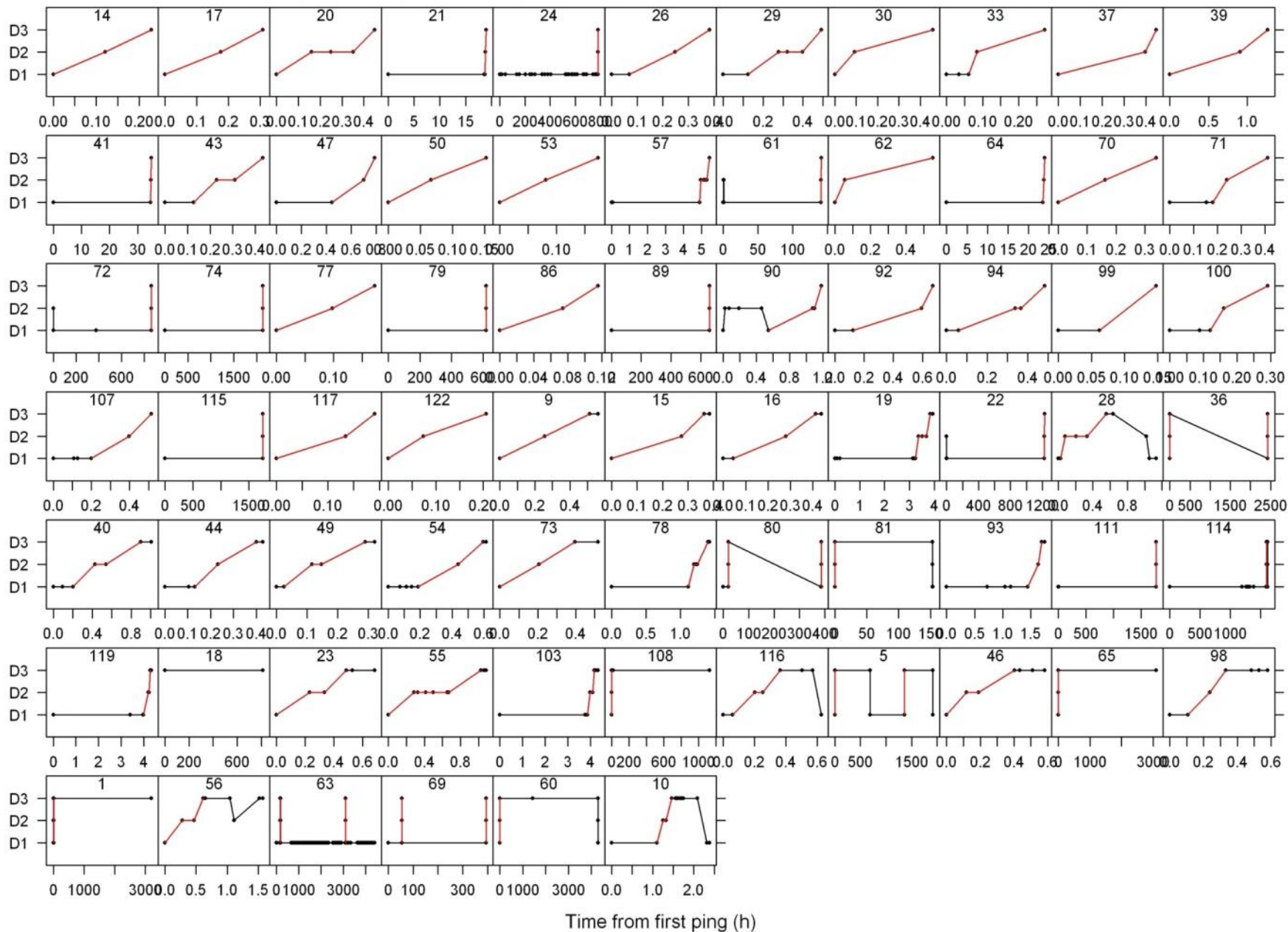
- “Natural”
 - Rock-Ramp (75)
- Technical
 - Vertical Slot (40)
 - Lock (5)
 - Denil (6)
- Design Guidelines



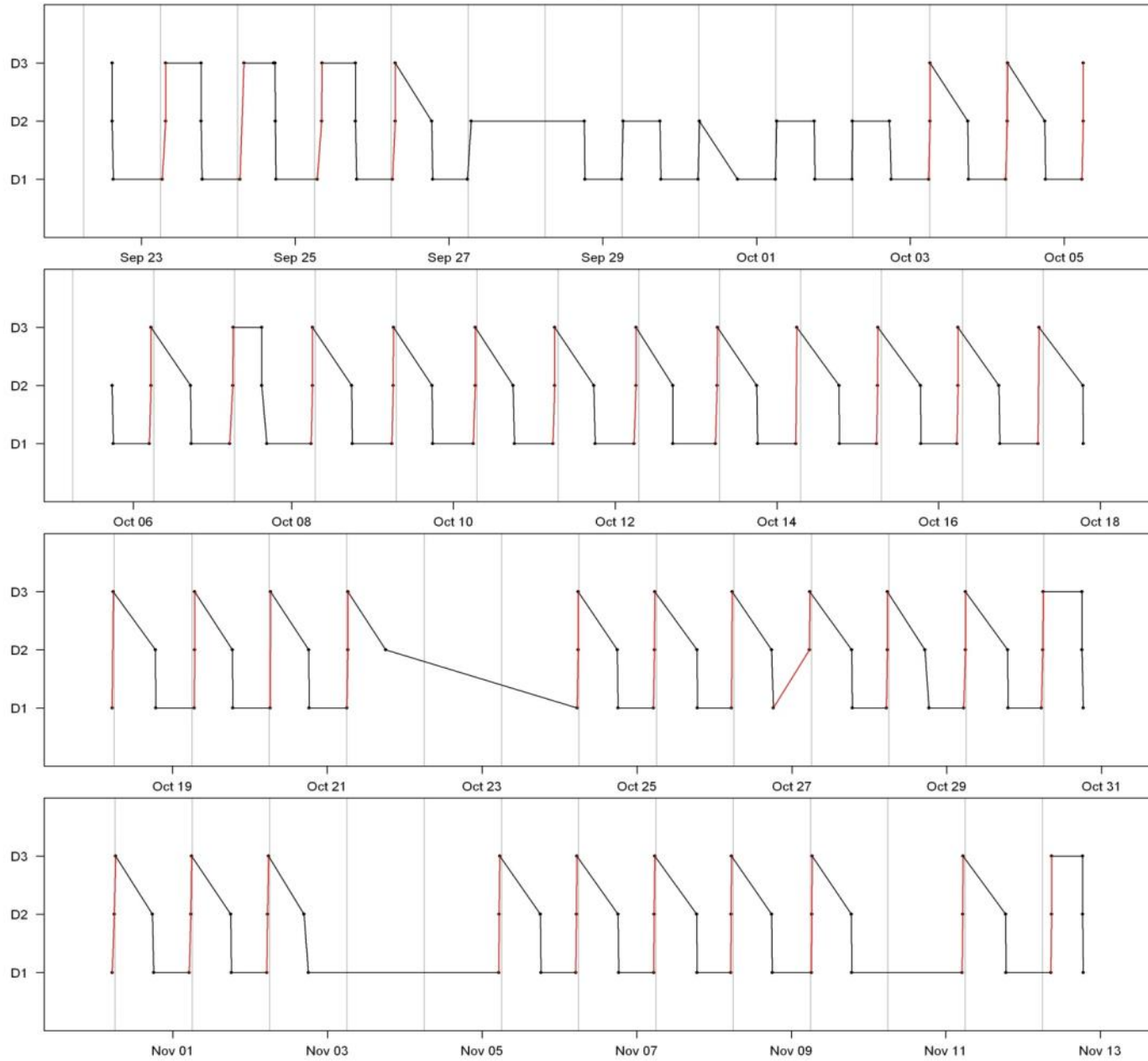
Fishways Pass Fish

- Murray Fishways each pass > 1 million fish per year
- Murray Lock 8 **Vertical Slot:**
passed 80,000 natives in 24 hrs
- Euston **Fish Lock** – passed
25,000 natives in 24 hrs





The Daily Cod



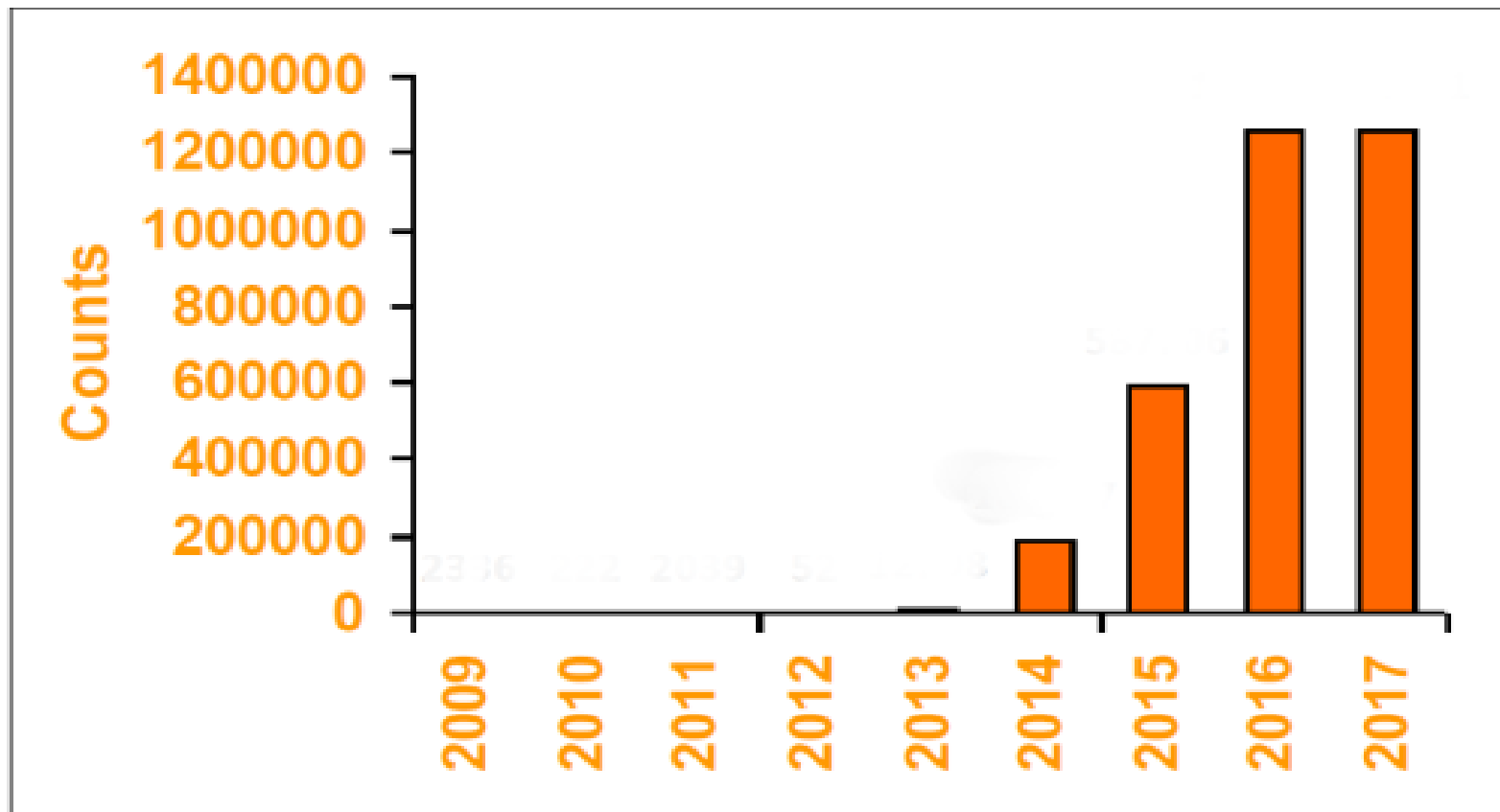
South Pine Rock Ramp



Matt Moore, Catchment Solutions QLD

Fish Passage = More Fish

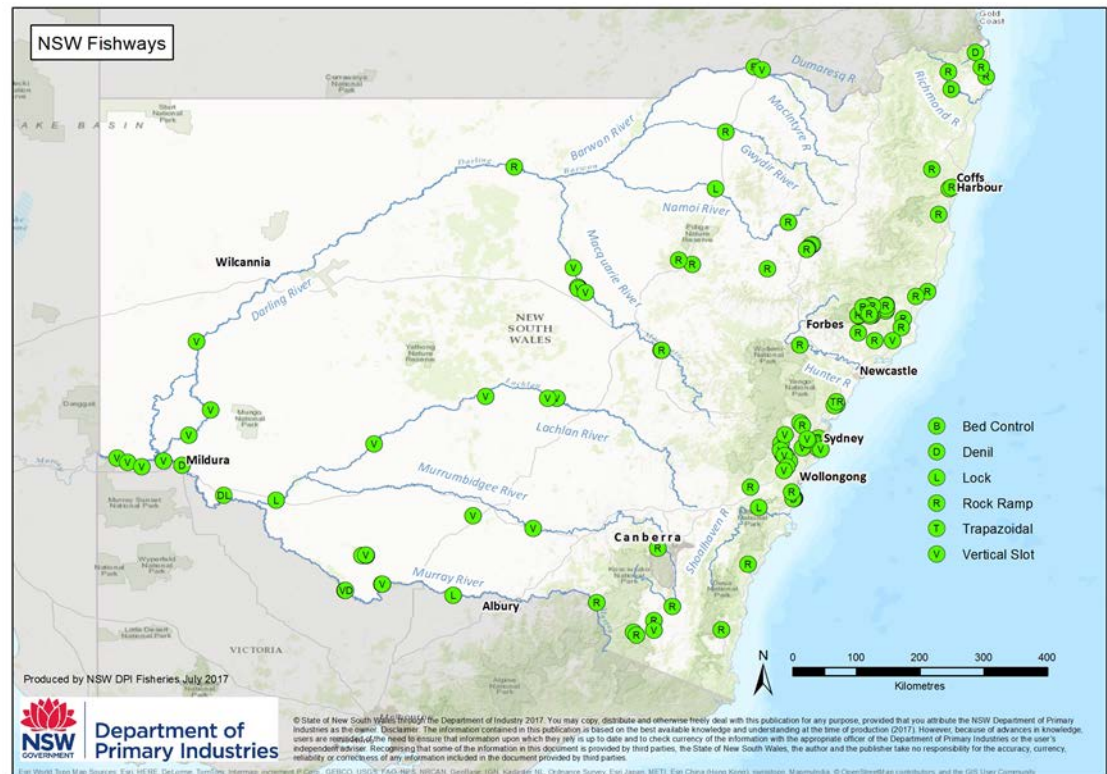
Accumulative River herring catch-to-date by year.



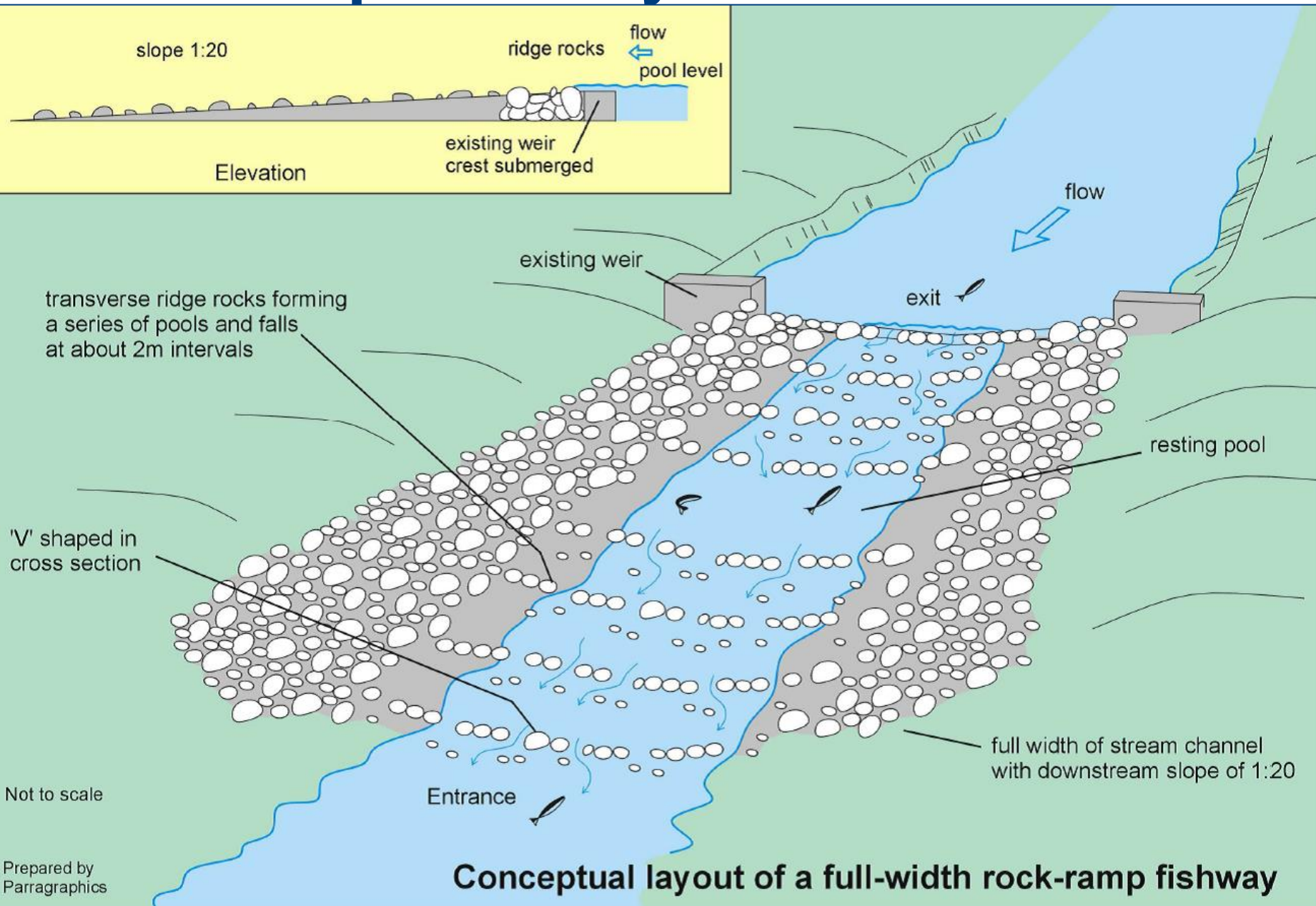
Penobscot River, Maine: 2018 returning fish = 2.2 million; 50 – 100 million juveniles

NSW Fishway Audit / Review

- Lessons Learned
 - Construction
 - Operation
 - Maintenance
 - Cost



Rock-Ramp Fishways



Full-width Rock-ramp (Weirs < 2 m)

■ Advantages

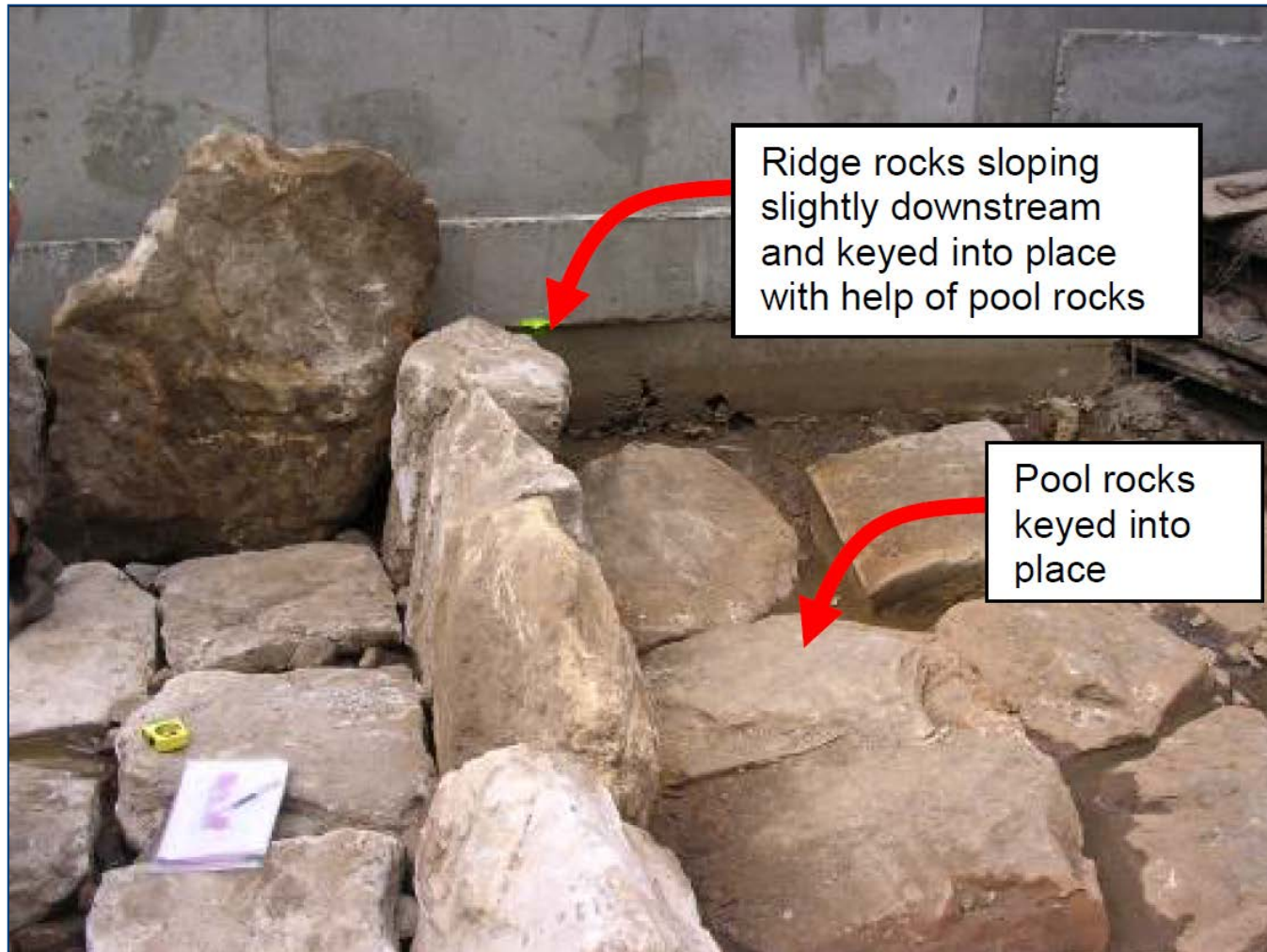
- Operating range
- Fishway entrance
- High biomass



■ Limitations / Issues

- Weirs < 2 m
- Wide waterways
- Water depth
- Difficult to construct
- Maintenance
- Debris

Keyed Rock Placement



M. Mallen-Cooper – Fishway Consulting Services



Primary
Industries

Headloss Consistency



Rock movement & Debris



Tailwater Lowering & Failure



V-Shaped Prefabricated Rock-Ramp



Recessed Partial-width Rock-ramp



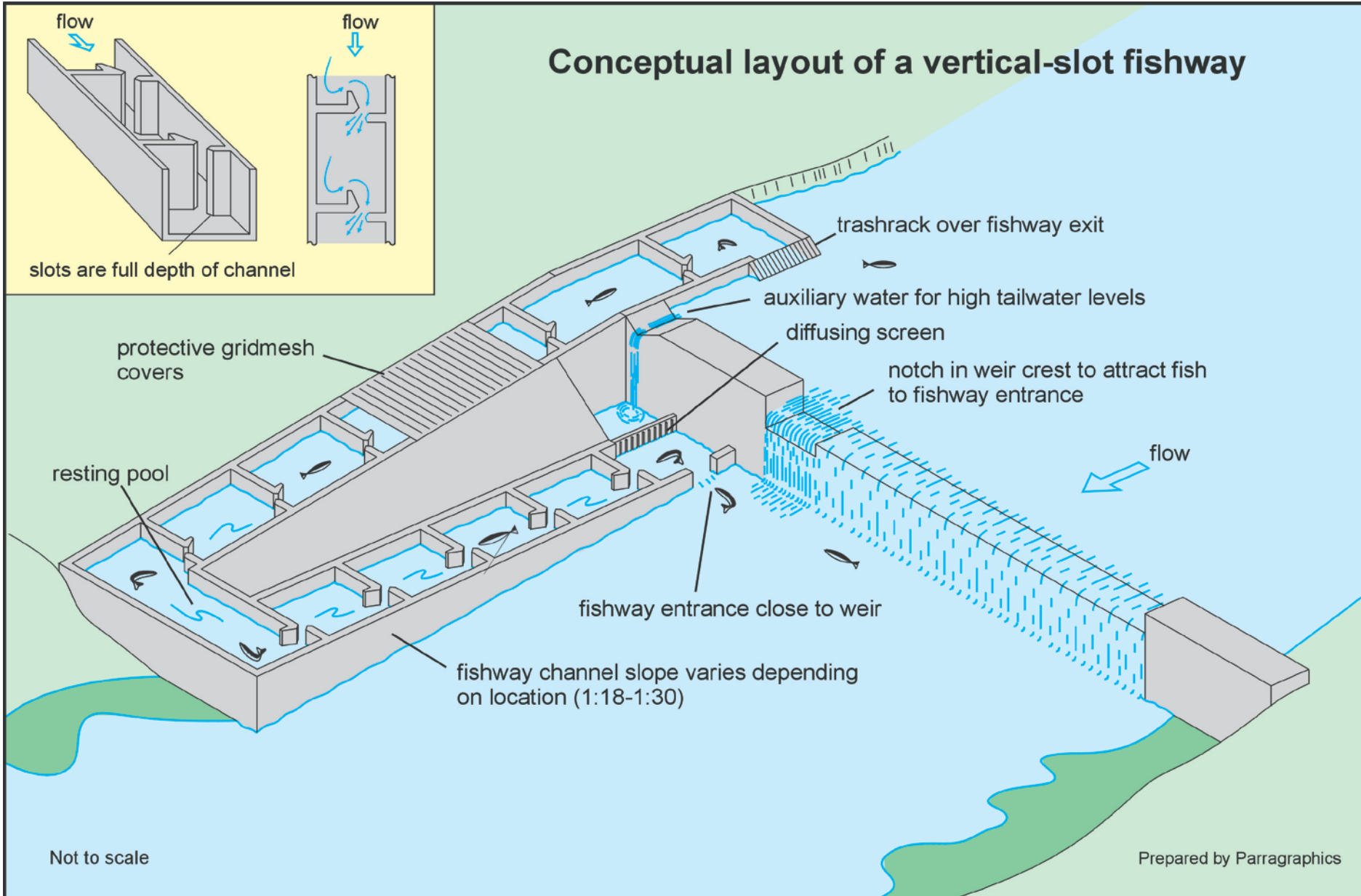
Brewarrina Weir

Prefabricated Cone Ramps



Tim Marsden – Australasian Fish Passage Services

Vertical Slot



Vertical Slot (Weirs 1 – 7 m)

■ Advantages

- Full-depth slot / water depth
- Low velocities & turbulence
- Small & large fish
- High biomass
- Operating / flow range
- Self-cleaning
- Low OPEX

■ Limitations / Issues

- Large footprint
- Higher CAPEX
- Debris
- Entrance conditions

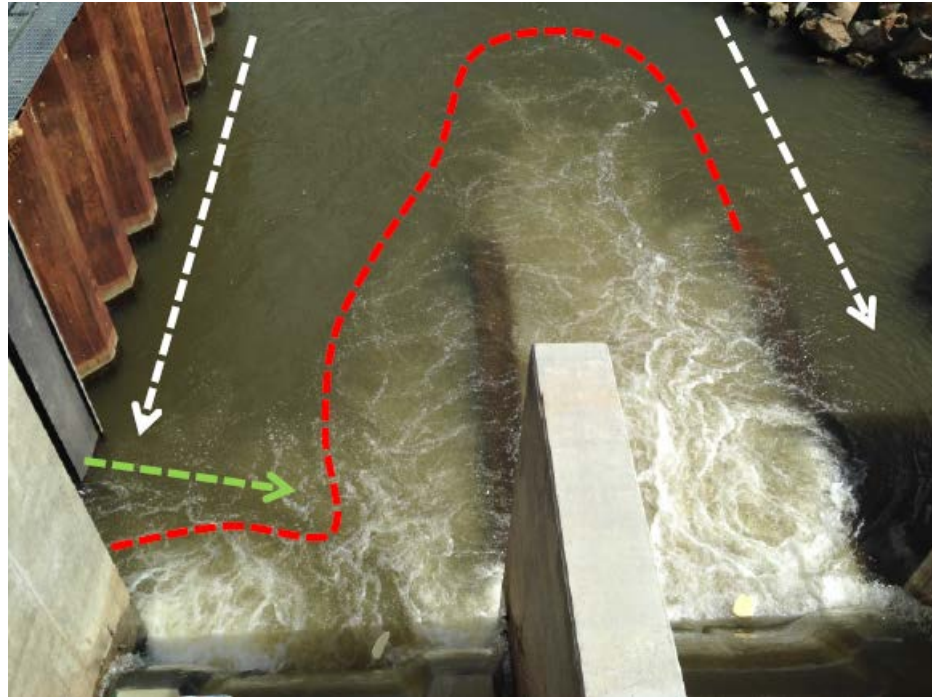
Vertical Slot - Debris



Fishway Entrance – Fixed Crest

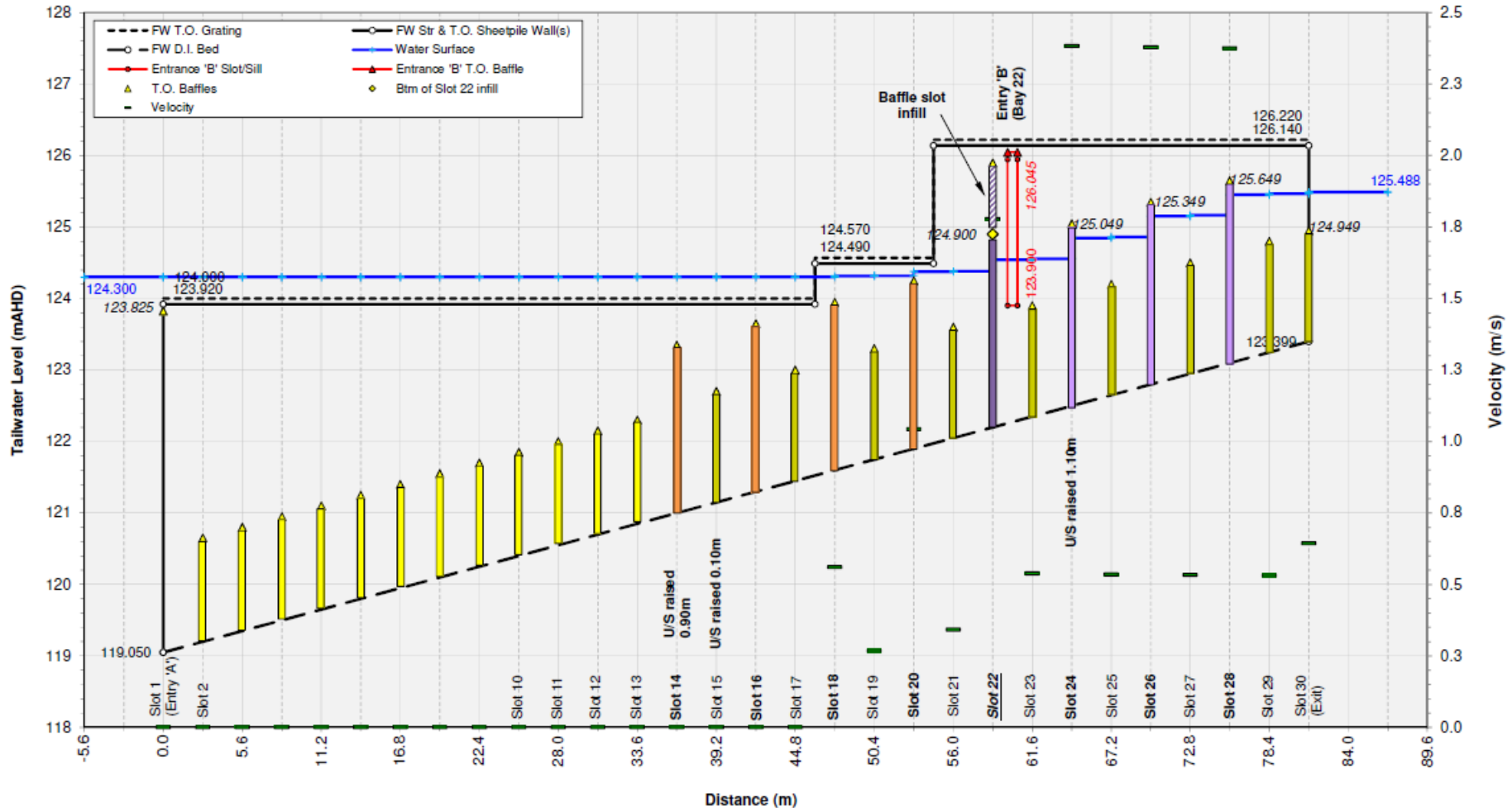


Fishway Entrance – Regulators



Multiple Entrances & Exits & Gates

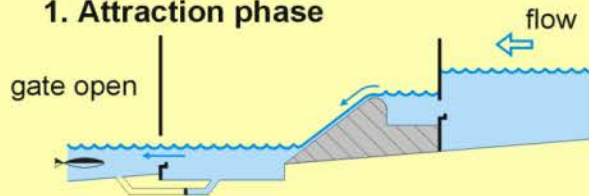
Vertical Slot Fishway Hydraulic Results for ENDEXIT - 4064 ML/d



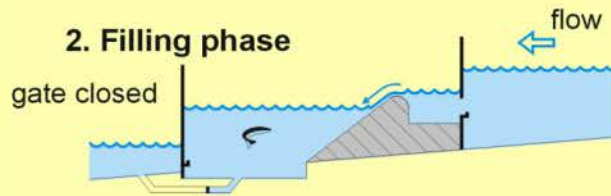
Lock Fishway

Conceptual layout of a low-level lock (Deelder) fishway

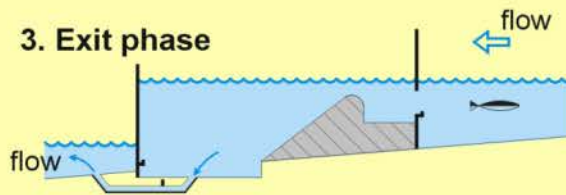
1. Attraction phase



2. Filling phase



3. Exit phase



Elevation

Filling phase

fishway entrance gates
close to weir

fishway exit

notch in weir crest to attract
fish to fishway entrance

flow

Not to scale

Prepared by Parragraphics

Lock Fishway (Weirs > 5 m)

■ Advantages

- Operating range
- High head weirs
- Smaller footprint
- Small fish passage

■ Limitations / Issues

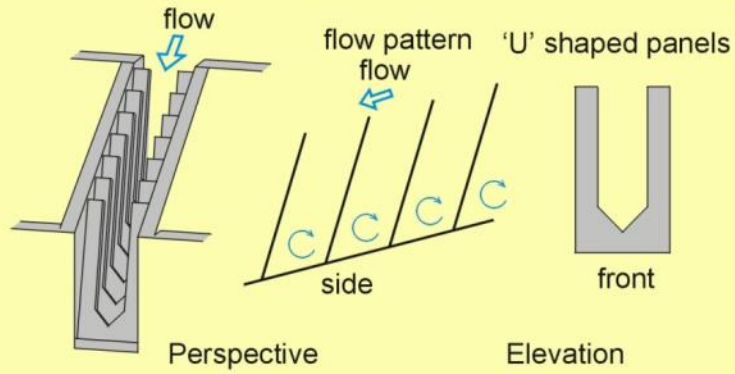
- Power required
- Complexity
 - Gates
 - Sensors
 - Valves
 - PLC Codes
- Cyclical operation
- High OPEX

Gate Operation



Garry Fyfe - SA Water

Denil Fishway



Conceptual layout of a Denil fishway

resting pools required every 12m (1m elevation)

Protective gridmesh covers

fishway entrance close to weir

cut-away section showing progress of fish up channel

fishway channel on 1:12 slope

trashrack over fishway exit

auxiliary water for high tailwater levels

diffusing screen

notch in weir crest to attract fish to fishway entrance

flow

Not to scale

Prepared by Parragraphics

Denil Fishway



- **Limitations / Issues**
 - **Small-bodied fish**
 - **Surface swimmers**
 - **Limited HW range**
 - **Higher discharge**
 - **Lower biomass**
 - **Debris**
 - **Vandalism**

Fishway Costs

- 2000's - \$150K / m
 - Burtundy - \$450 K
- 2013 - \$1.2 M / m
 - Vertical Slot - \$2.6 M

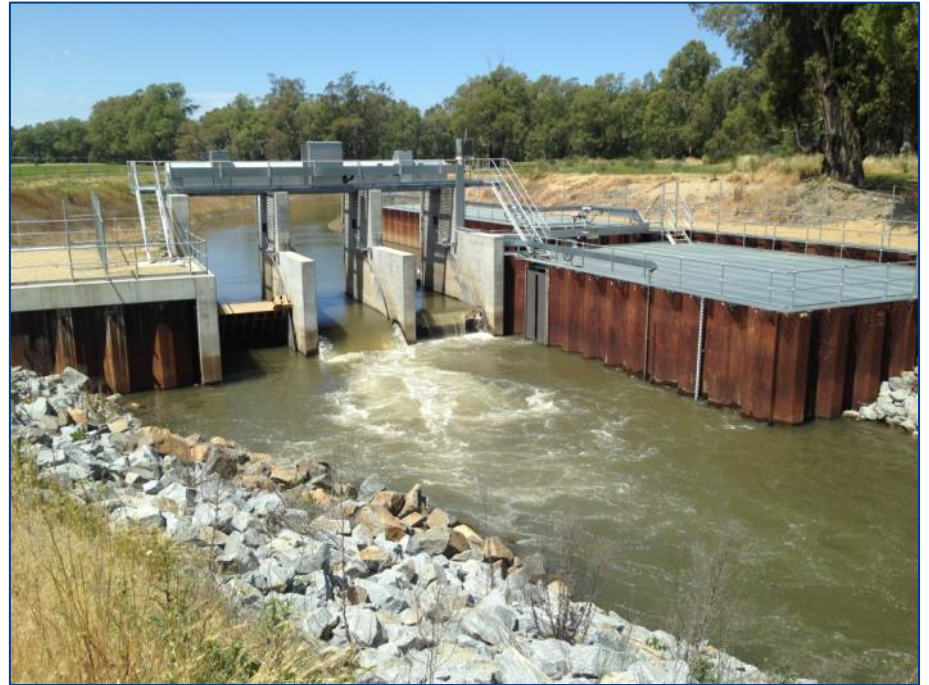


Burtundy Weir

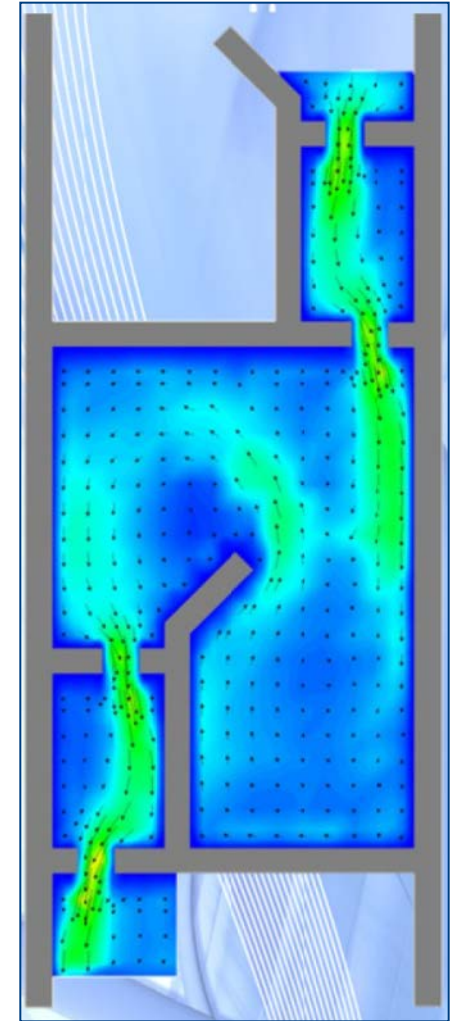
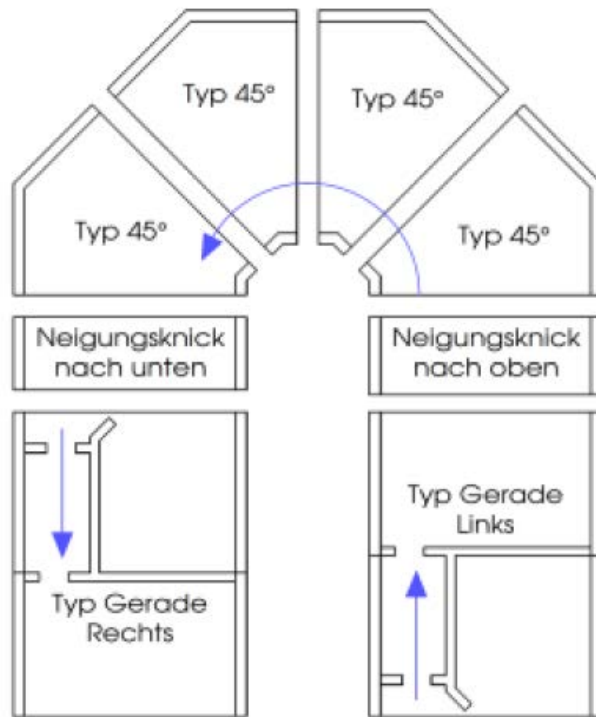


Fishway Costs Saving Measures

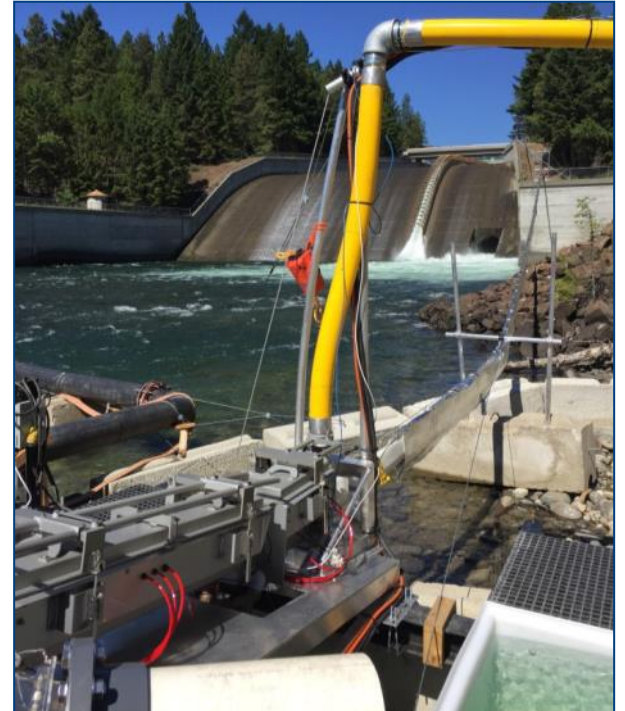
- Material choice
- Contractor risk
- Procurement process
- Design optimisation
- Prefabrication
- Novel designs



Prefabricated – MABA eNature FishPass

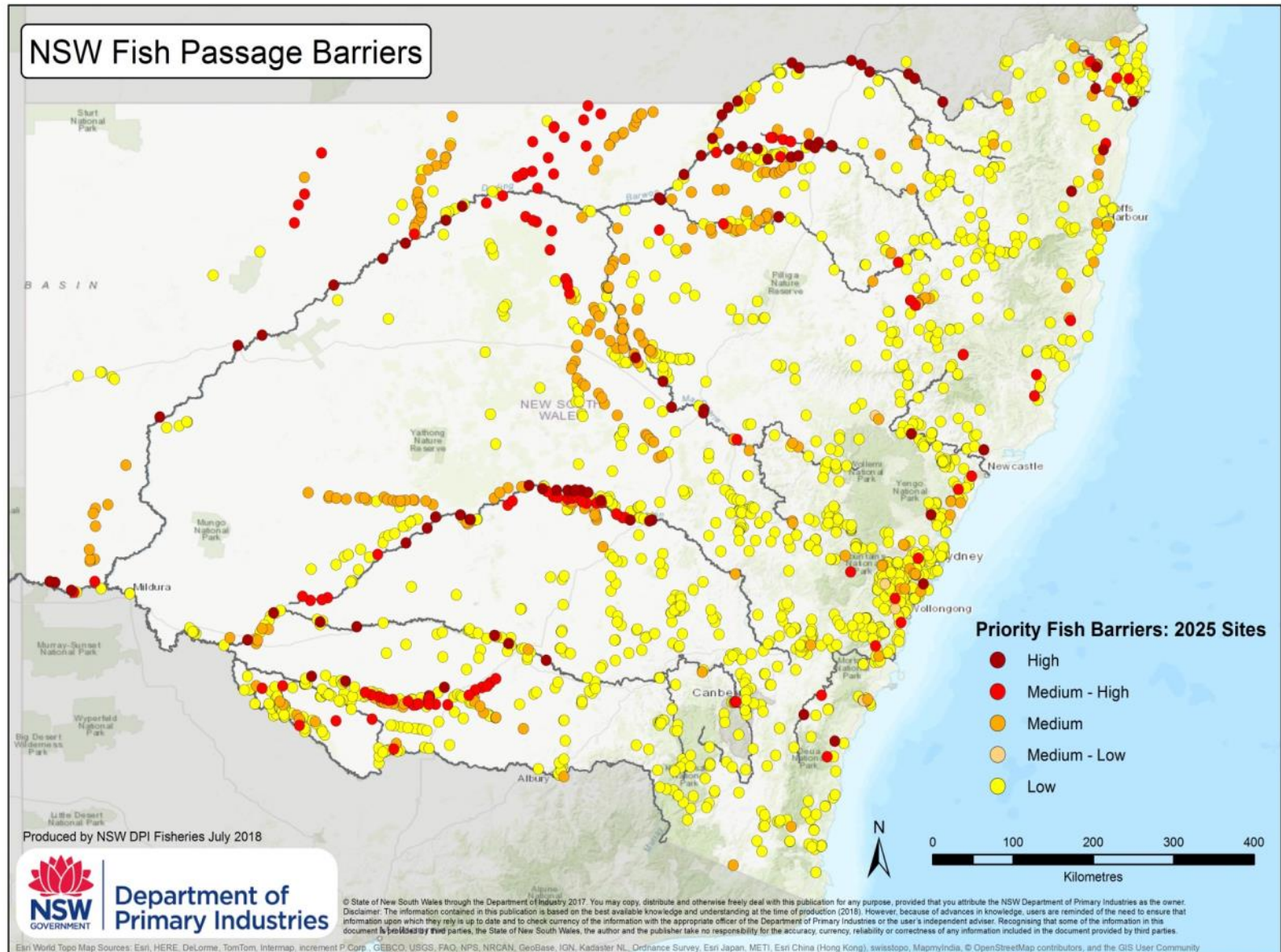


Novel Designs – Whooshh “Salmon Cannon”

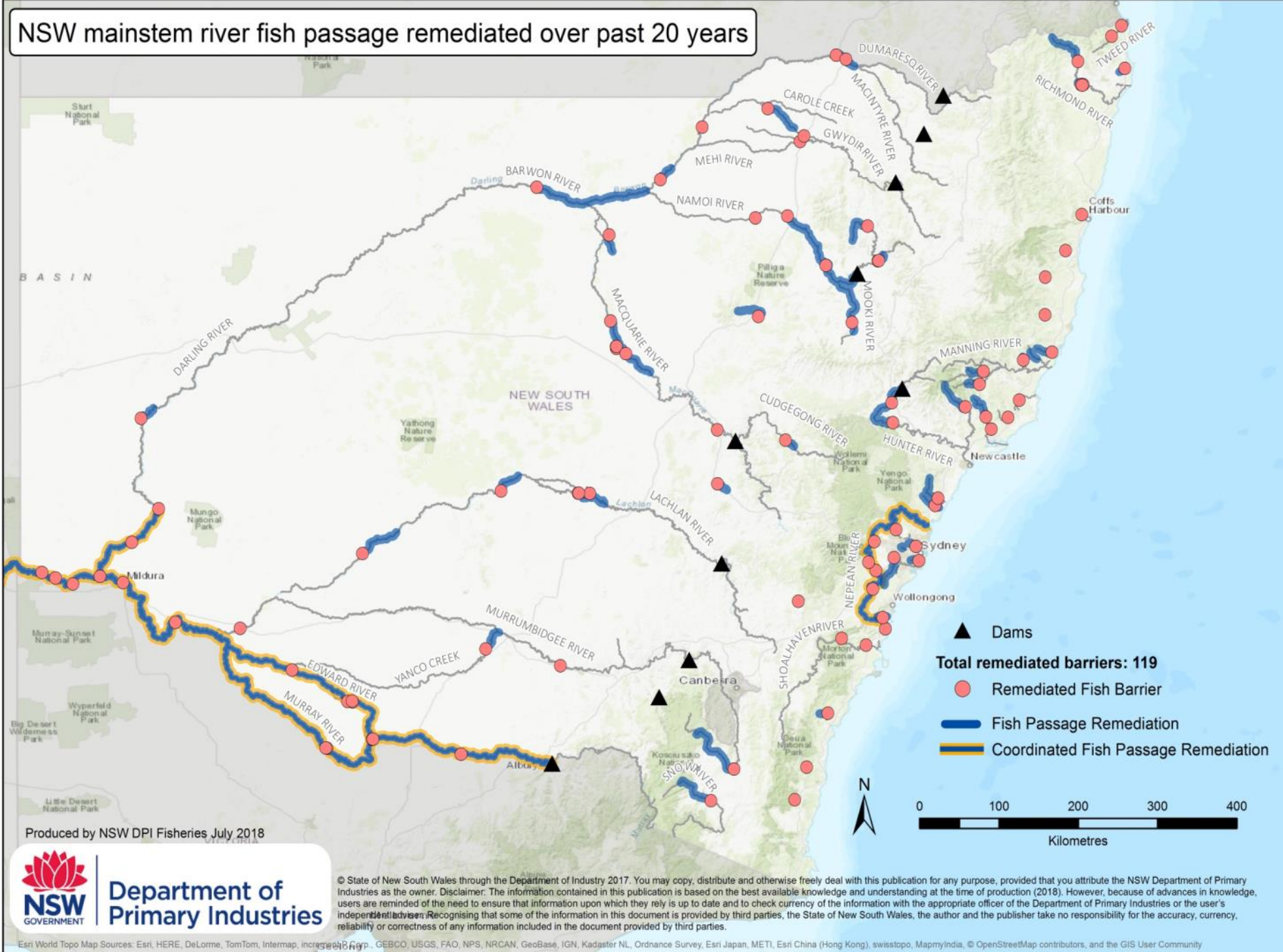


<https://youtu.be/uCxNC5cJuOo>

Ministerial Fish Passage Task Force

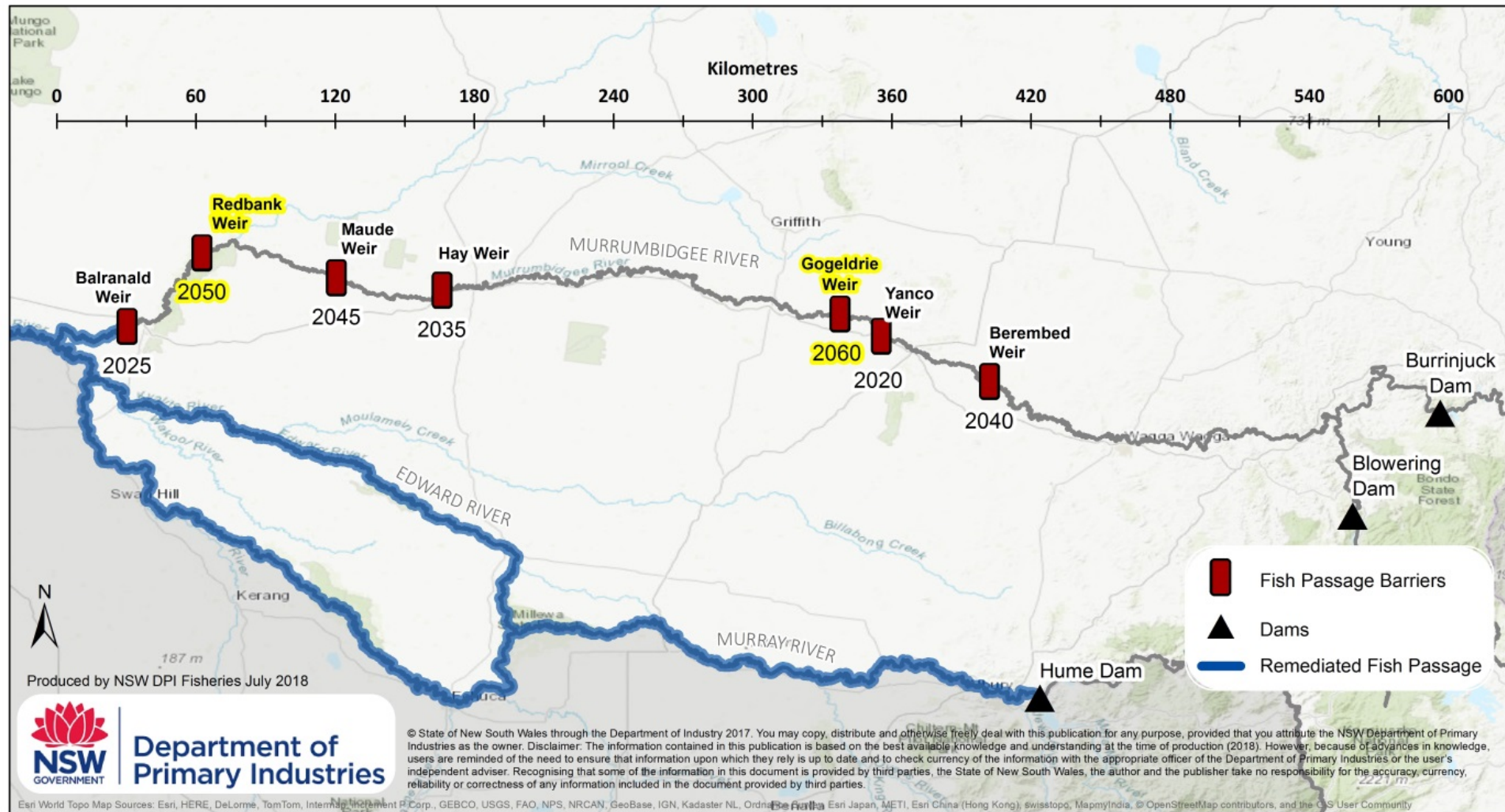


NSW mainstem river fish passage remediated over past 20 years

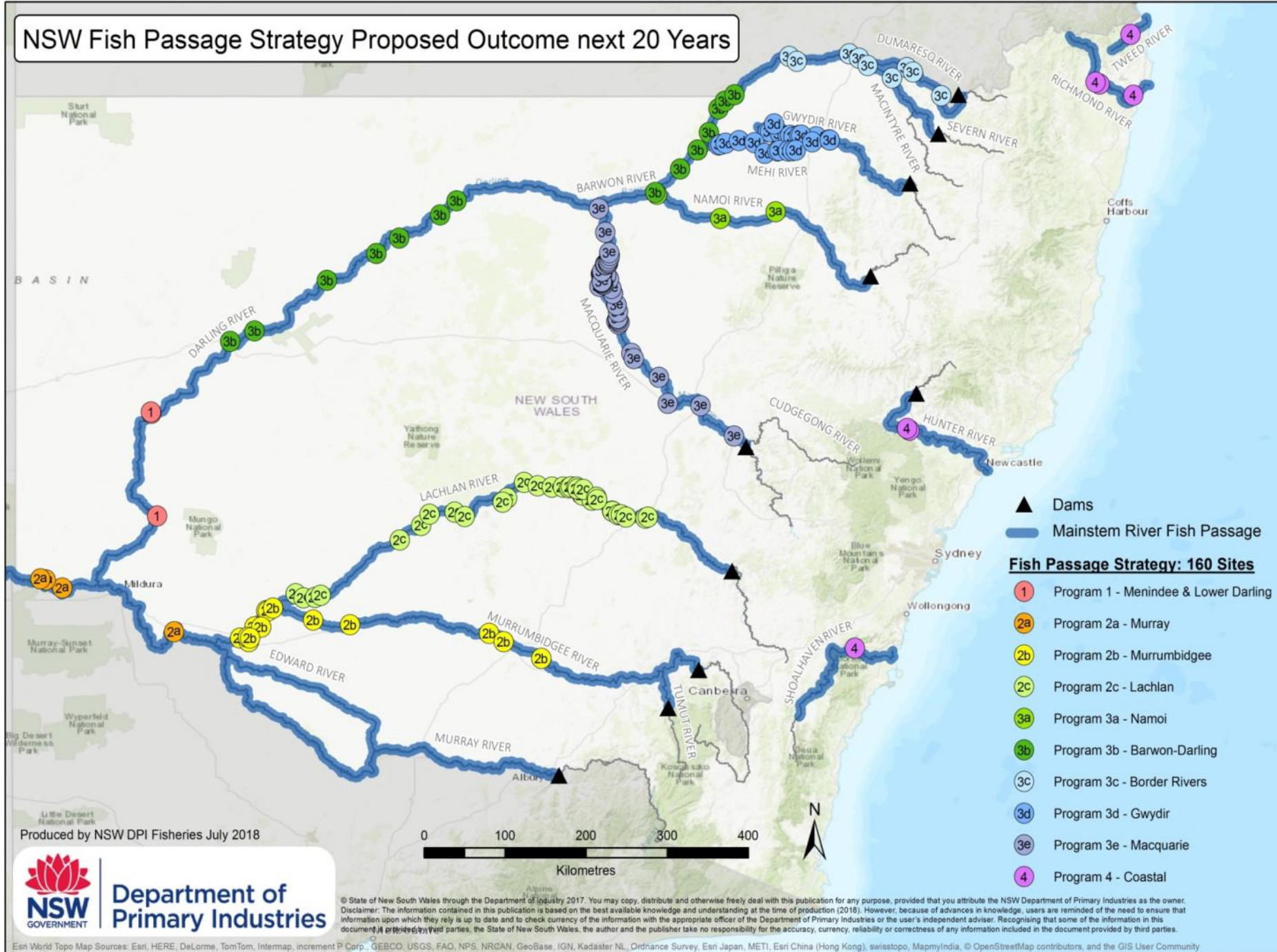


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NSW Fish Passage Strategy Proposed Outcome next 20 Years



NSW Fish Passage Strategy Aims

- Remediate 160 priority barriers over 20 years to improve fish access to nearly 8,500 km of mainstem rivers
- Achieve catchment scale connectivity decades ahead of the current approach.
- Double native fish populations by 2050
- **Optimise cost-effective fishway design and delivery**



FISH PASSAGE 2018 - INTERNATIONAL CONFERENCE ON RIVER CONNECTIVITY

INCORPORATING THE FIRST SYMPOSIUM ON HYDROPOWER AND FISH MANAGEMENT

DECEMBER 10-14, 2018 | ALBURY, NEW SOUTH WALES (AUSTRALIA)



More information

<http://fishpassage.umass.edu/>
www.dpi.nsw.gov.au/fisheries/habitat

Matthew Gordos
Fish Passage Manager
NSW DPI - Fisheries

E | matthew.gordos@dpi.nsw.gov.au

M | 0427 243 343