

**Roughened Channel Fishways
at Hard Structures**
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- ANADROMOUS
- High value fish and fish of current concern
- Best and most technology from PNW
- Smolts 10-15 cm
- Adults 50 cm+
- Technology requires adjustment for inland water fishes



- INLAND
- Small sport fish (25 cm+) or “minor” fish target to as small as 3 cm



- EXOTIC OR PROBLEM
- Can jump and can be strong swimmers
- Can use same facilities

Application of Roughened Channels to Hard Structures – Inland Fishes



- Improve passage, but not ideal passage (not always able to construct natural stream equivalent)
- Flexibility (possibly make further improvements in future)
- Versatility (several passage routes)

- Sizing based on Mannings

$$Q = \frac{1.49}{n} R_H^{2/3} S^{1/2}$$

$$\eta = 0.06 - 0.12 \quad (0.10 \text{ used})$$

Goal – Define R_H For 1' depth at target flow
Check stability under full flow

- Stability based on average shear stress along the wetted perimeter

$$\tau_o = \gamma R_H S \quad (\text{Shear Stress})$$

R_H From Hydraulics

S From Geometry $SEGL = SHGL = S_o$

$$\tau_o \leq \tau_R$$

- KEY CHARACTERISTICS – INLAND FISHES
- Do not depend on jumping ability or frequent use of burst speed – only small jump (15 cm) or short reach of burst speed (50 cm)
- Fish have a defined preference for swimming (prolonged speed) – ability based on species, but mostly on size and temperature
- Target fish – When first mature or when first move to spawn
- Usability and applicability of common criteria needed on size, type or surrogate (definitions and available information)

- Space for fishway, particularly length
- Positioning entrance
- Consideration of diverter rights (e.g. not taking attraction or conveyance water for fish from diverter's water, not adversely impacting diverter infrastructure, etc)

Characteristics of Resulting Fishways

- An improvement over Denil or Alaska Steep Pass fishways
- Not all fish sizes/types can pass 0 but many mature and highly valued fish can pass
- Creates an awareness of need

- S. BOULDER CANYON DIVERSION
- Target fish – 25 cm rainbow trout
- Challenge – difficult construction access in protected area
- Solution – full channel width compound GSB roughened channel fishway
- Unique components – a sport fish spawning run occurs from downstream reservoir via irrigation ditch to stream



- MCGINN DITCH DIVERSION
- Target fish – 10 cm rainbow trout
- Challenge – ditch company cooperation
- Solution – 4.5% dedicated sculpted concrete roughened channel fishway
- Unique components – an existing structure bypass and attraction flow created a false fish passage route that had to be removed



- WALDEN-SAWHILL DIVERSION
- Target fish – none (10 cm assumed)
- Challenge – small head at site and right to divert only at high flow rates created greater swim through passage challenge at higher flows
- Solution – full channel width GSB roughened channel fishway
- Unique components – burst speed passage of single drop

