

# Overview of Fish Passage Design Approaches



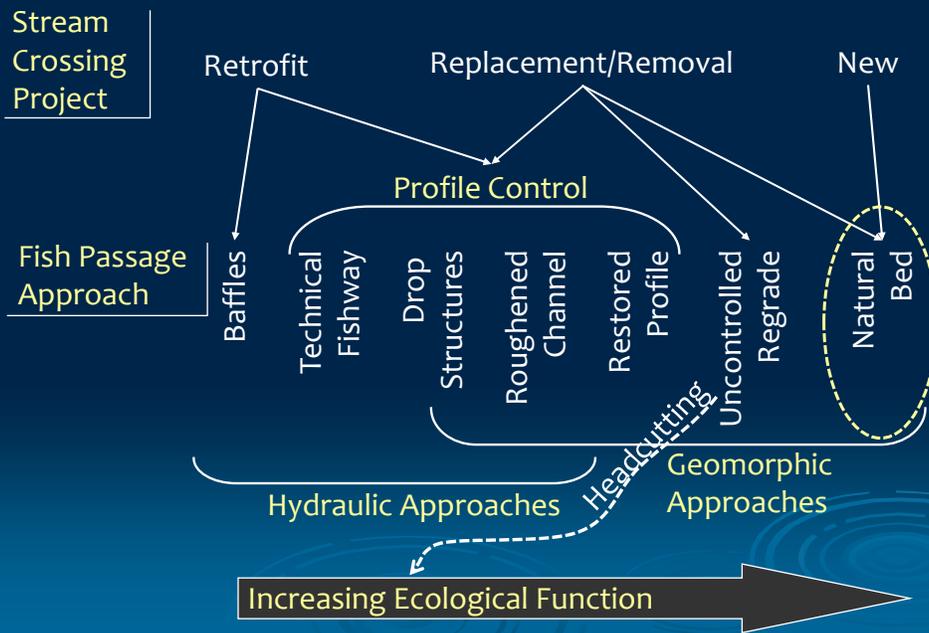
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CDFW California Salmonid Stream Habitat Restoration Manual (SSHRM)  
 Part XII : Fish Passage Design and Implementation

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## Design Approaches for Aquatic Organism Passage



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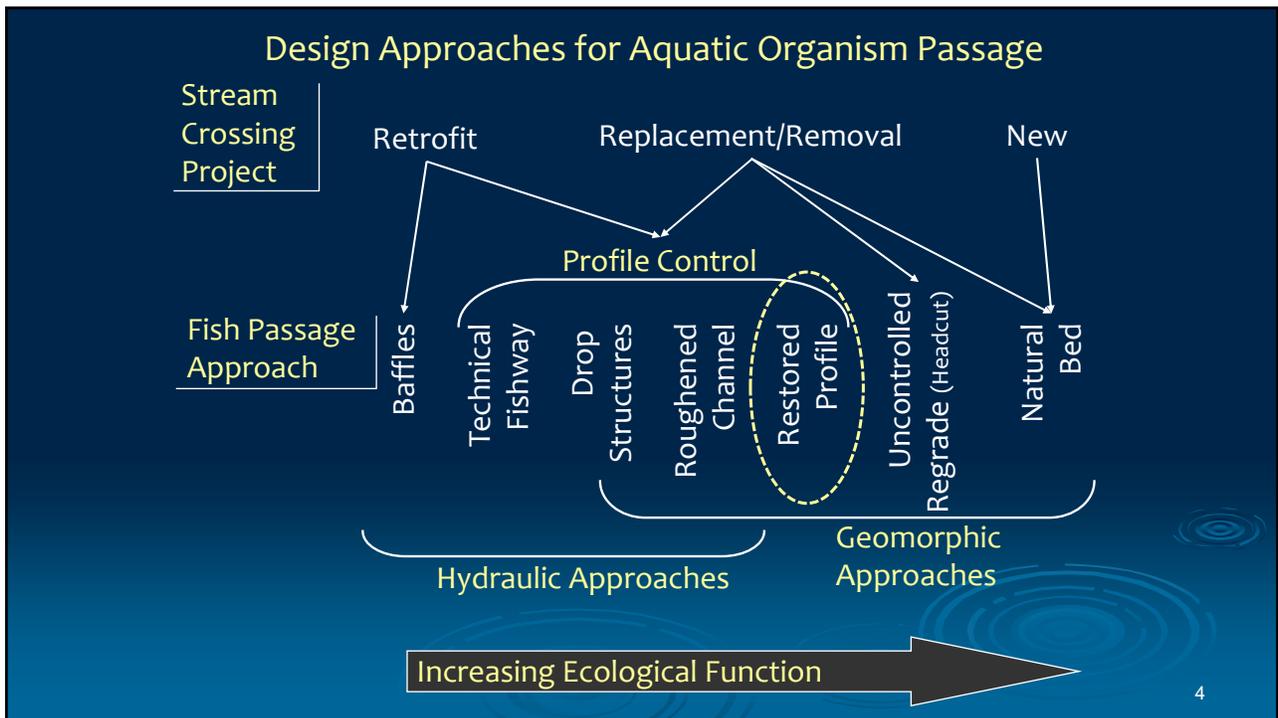
# Stream Simulation

## Natural Bed Options for Stable Streams



See:  
 USFS Stream Simulation Design Manual (2008)  
 CDFG SSHRM Part XII (2009)

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## Profile Restoration

Restoring the profile of an incised channel downstream of a crossing



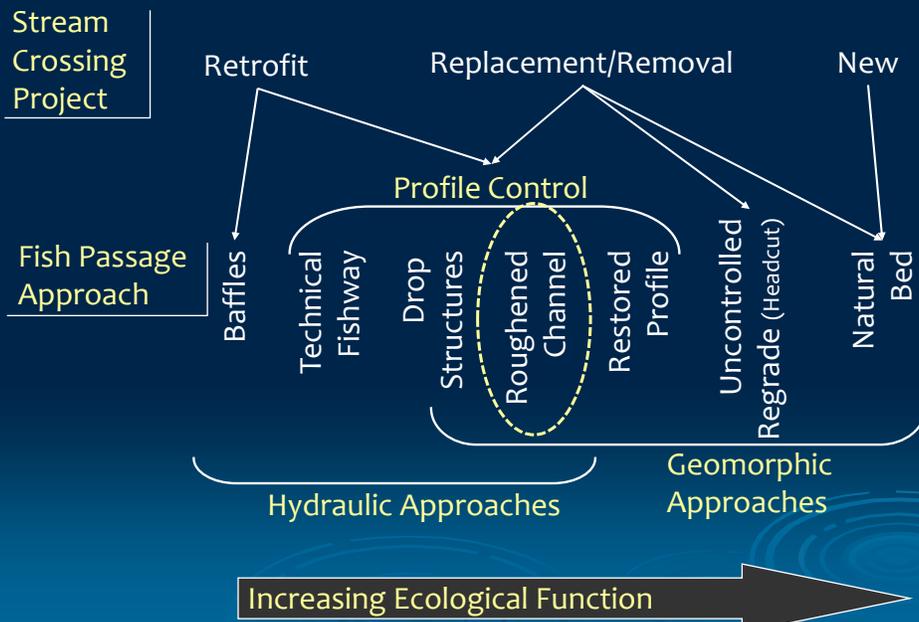
From Christine Chann  
San Pedro Creek Watershed Coalition

See:  
CDFW Fish Bulletin 185 (2024)  
CDFG SSHRM Part XII (2009)

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## Design Approaches for Aquatic Organism Passage

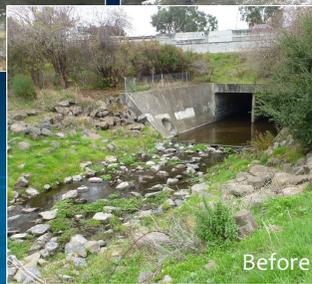


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## Nature-Like Fishways (Roughened Channels) Geomorphically-Based Profile Control

Penitencia  
Creek



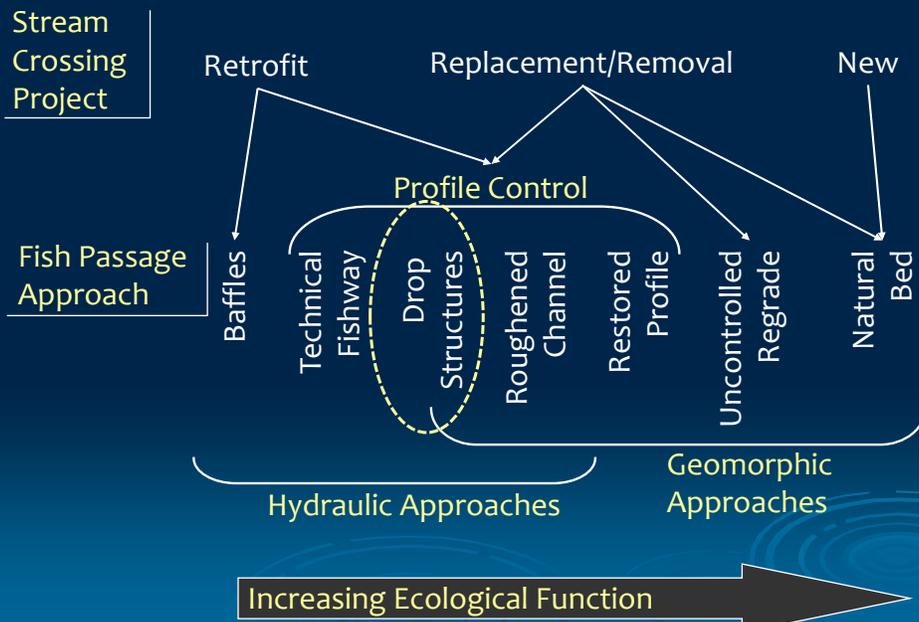
Pinole Creek at I-80

See:  
CDFG SSHRM Part XII (2009)

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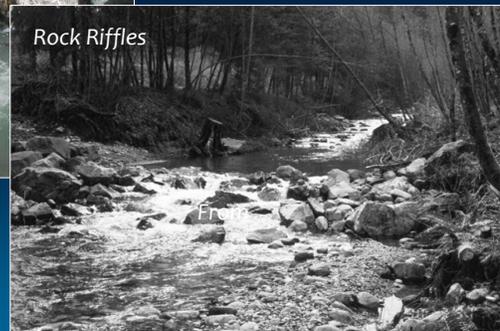
## Design Approaches for Aquatic Organism Passage



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## Boulder and Log Weirs Drop Structures for Profile Control

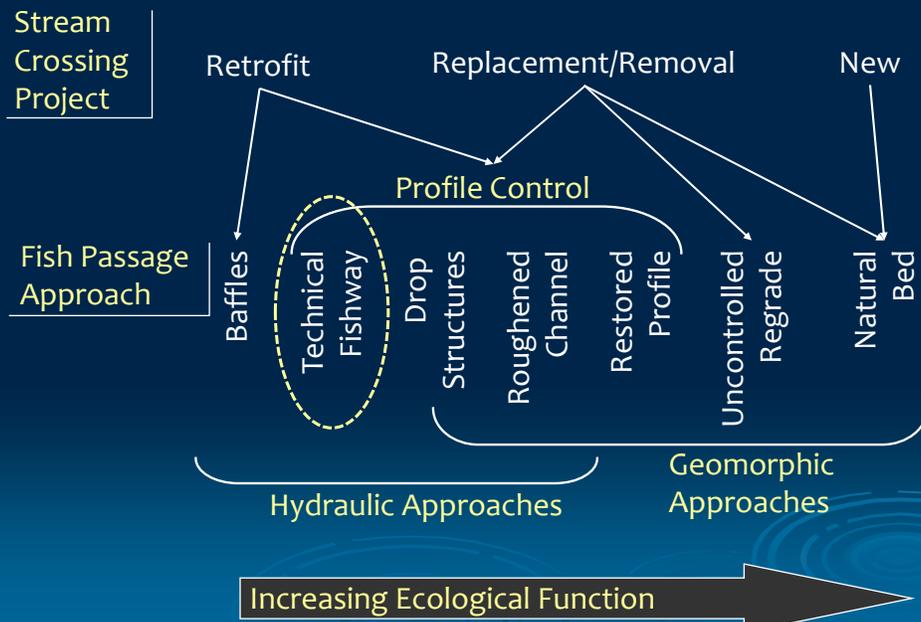


Covered in CDFW Fish Bulletin 183 (2024)  
and CDFG CA SHRM Part XII (2009)

from Newbury (2013) Design fish-passable riffles as gradient controls in Canadian streams

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## Design Approaches for Aquatic Organism Passage



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## Technical Fishways Profile Control



Peacock Creek, Smith River, Calif.



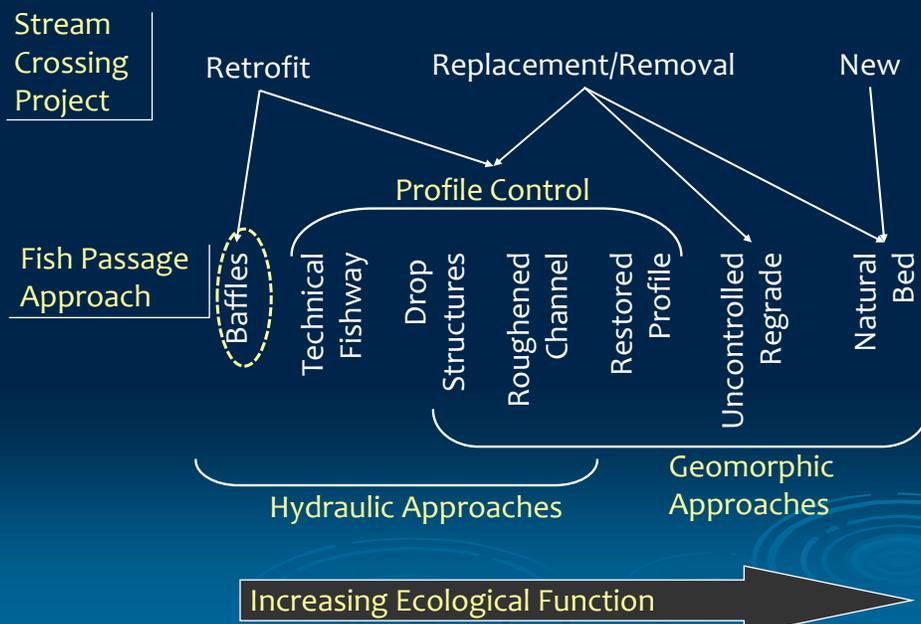
Before

Vortex  
Pool & Chute Fishway

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## Design Approaches for Aquatic Organism Passage



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## Retrofits Fish Baffles



Pinole Creek at I-80



Strong's Creek



US101 at Clam Beach Offramp

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## Preferred Stream Crossing Design

1. **Nothing** - Road realignment to avoid crossing the stream
2. **Bridge** - span the stream corridor for long term dynamic channel stability
3. **Stream Simulation** - mimics characteristics of the natural channel
  - Baffled culverts, technical fish ladders, roughened channels, nature-like fishways. Often used for retrofits.
4. **Hydraulic Design** - target depth, velocity, jump height, for specific species



Huichica Creek @  
SR 121 (Napa)  
a) before  
b) after

Slide provided by Emily Thomas, NOAA Fisheries



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## Stream Simulation

Example of a Small Stream Crossing Application

McGarvey Gulch

4-foot Dia. CMP on Low-Volume Road



Outlet Headwall and Apron

Steelhead Trout Stream



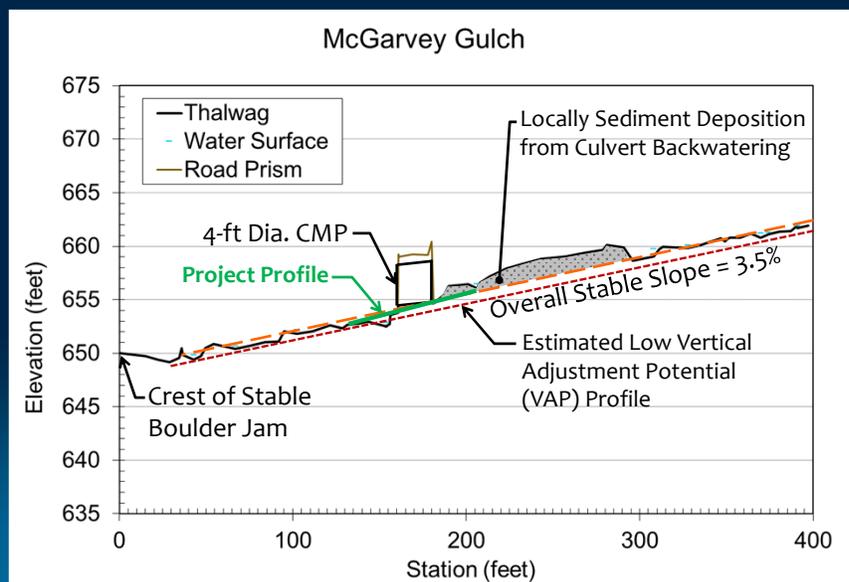
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## Stream Simulation

Example of a Small Stream Crossing Application

McGarvey Gulch



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## Stream Simulation

### Example of a Small Stream Crossing Application

Upstream Channel (beyond culvert influence)  
Serves as Reference Reach for Design



#### Reference Reach:

Channel Type: Plane Bed (rapid)  
Channel Slope = 3.4%

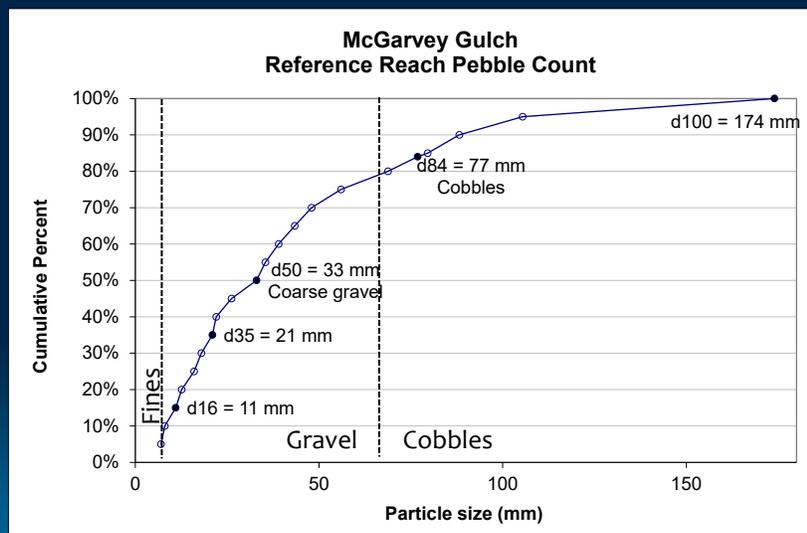
Ave. Active Chnl Width = 5.4 ft  
Ave. Bankfull Width = 7.5 ft

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## Stream Simulation

### Example of a Small Stream Crossing Application



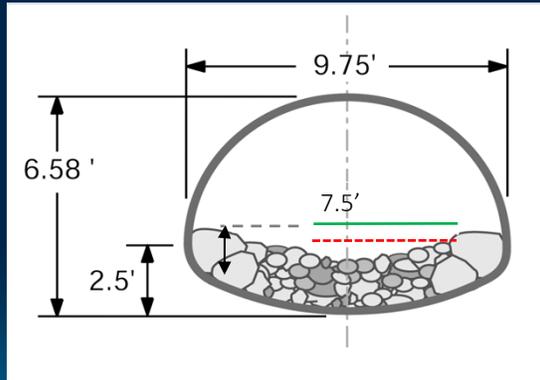
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## Stream Simulation

### Example of a Small Stream Crossing Application

#### McGarvey Gulch Crossing Design



- Pipe-arch Metal Culvert
- Span =  $1.3 \times \text{Bankfull Width}^{(1)}$
- Invert Embedded 2.5 feet below Project Profile (1.5 feet below Low VAP Profile)
- Large Rocks inside along Culvert Walls form Banks

<sup>(1)</sup> NOAA Guidelines now required Span >  $1.5 \times \text{Bankfull Width}$

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## Stream Simulation

### Example of a Small Stream Crossing Application

#### Checking Culvert Capacity at Q100 with FishXing



- ✓ HW/D < 1.0 (Headwater below Soffit)
- ✓ Subcritical Flow in Culvert (Outlet Controlled)

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# Stream Simulation

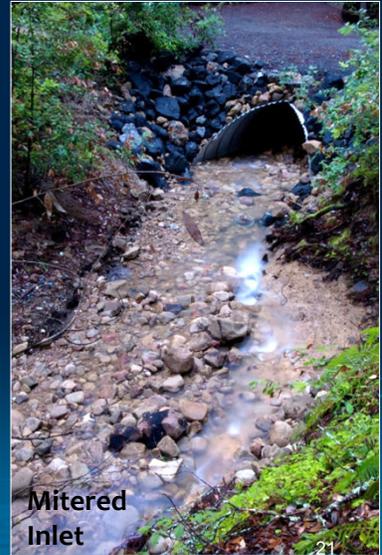
## Example of a Small Stream Crossing Application

### McGarvey Gulch Post-Project



Outlet

Photos: Matt Stoecker



Mitered Inlet

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